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WENT (JOHANNA C.). **Verslag van de onderzoekingen over Iepenziekten, verricht op het Phytopathologisch Laboratorium 'Willie Commelin Scholten' te Baarn, gedurende 1944. Verslag van de onderzoekingen over de Iepenziekte, verricht op het Phytopathologisch Laboratorium 'Willie Commelin Scholten' te Baarn, gedurende 1945.** [Report on the investigations on Elm diseases conducted at the 'Willie Commelin Scholten' Phytopathological Laboratory, Baarn, during 1944. Report on the Elm disease investigations conducted at the 'Willie Commelin Scholten' Phytopathological Laboratory, Baarn, during 1945.]—*Meded. Inst. toegep. biol. Onderz. Natuur* 41, pp. 5–24, 1946.

The inoculations performed in connexion with the project of testing elm seedlings for their reaction to the agent of the Dutch elm disease [*Ceratostomella ulmi*: cf. *R.A.M.*, xviii, p. 557] numbered 6,000 in 1944 compared with 4,440 in 1943. The decision was again reached to continue the work of hybridization with *Ulmus hollandica vegeta*, *U. foliacea* Nos. 1 and 28, *U. glabra* No. 49, *U. wallichiana*, and *U. pumila pinnato-ramosa*. Specially promising results were given by the cross between *U. h. vegeta* and *U. foliacea* No. 1. The incidence of infection (60 per cent.) among the progeny of open-pollinated *U. foliacea* Christine Buisman was no lower than the average for other varieties. Inoculated scions of six selected lines appeared to remain completely healthy, viz., two of the cross between *U. h. vegeta* and *U. foliacea* No. 1, one each of *U. h. pitteursi* × *U. h. vegeta* and *U. h. vegeta* × *U. foliacea* No. 28, and the open-pollinated Nos. 5 and 25. Ten of the 48 inoculated specimens of *U. foliacea* No. 62 contracted infection by *C. ulmi*.

The study on the period of maximum susceptibility in elms to infection by *Nectria cinnabarina* [cf. ibid., xvii, p. 142] had to be suspended owing to the loss of virulence by the strains used as inoculum: a series of fresh isolations was made to replace them. The results of fertilizer experiments clearly showed that heavy applications of potash enhance the disease.

In 1945 the scope of the Dutch elm disease trials was limited. For six consecutive years the French seedling *U. foliacea* No. 62 and its scions have shown a reasonably high degree of resistance, with 12·8 per cent. infection (as against 7·4) for Christine Buisman; the somewhat greater susceptibility of the former line is outweighed by the generally mild nature of the symptoms, which had, as a rule, disappeared by the end of the summer. It was proposed to distribute material of *U. foliacea* No. 62 to nurserymen in 1946. The outcome of trials with the lines No. 132 of *U. hollandica* No. 5 and Nos. 139 and 147 of *U. h. vegeta* × *U. foliacea* No. 1 was also very encouraging. *U. hollandica*, *U. wallichiana*, and *U. laciniata nikkoensis* appear to provide the best material for female parents.

In an experiment involving the inoculation of 450 seedlings with three strains of *C. ulmi*, E6a, E3b, and 3_2, the last-named, isolated in 1936, caused a lower percentage of infection (30·2), with a higher proportion of mild cases, than the first two, dating from 1943 (44·8 and 39·6, respectively). These disparities seem to reflect a gradual loss of virulence in the case of 3_2 [cf. ibid., xxiv, p. 344].

When the inoculation tests with *N. cinnabarina* were resumed at the beginning of April, 1945, *U. foliacea* Christine Buisman developed much more extensive cortical necroses than *U. hollandica belgica.*

GILBERT (S. G.), SELL (H. M.), & DROSDOFF (M.). **The effect of copper deficiency on the nitrogen metabolism and oil synthesis of the Tung tree.**—*Plant Physiol.*, xxi, 3, pp. 290–303, 1946.

At the Field Laboratory for Tung Investigations, Gainesville, Florida, the leaves and fruit of copper-deficient *Aleurites fordii* [*R.A.M.*, xxiii, p. 463] were compared with those of normal trees in the same orchard at different times during the growing season to determine the effect of the shortage on the metabolic processes. The percentage of reducing sugar in the copper-deficient foliage was found to be low and that of starch outstandingly so, while the total nitrogen of the affected leaves always exceeded that of normal ones tested at the same time. Accumulation of the water-insoluble fraction, which largely accounted for the high nitrogen content, was a characteristic symptom of the deficiency, and it seems probable that in the absence of sufficient copper the plant forms abnormal quantities of complex nitrogen compounds at the expense of the carbohydrate reserves. The most important effect of the copper shortage on the fruit was the failure of the kernel to reach a normal size and synthesize a proper amount of oil.

MIELKE (J. L.). **Observations on Coleosporium crowellii.**—*Plant Dis. Reptr*, xxx, 11, pp. 422–423, 1946. [Mimeographed.]

In 1940, *Coleosporium crowellii* [*R.A.M.*, xix, p. 7] was fairly common on *Pinus edulis* in one part of the Black Range in the Gila National Forest, New Mexico, and on the same host in the Mesa Verde National Park, Colorado, in 1942. In September, 1945, this host was extensively infected in Grand Canyon National Park, Arizona, on the south side of the canyon, affected trees being found over several square miles. There was some evidence of differences in individual susceptibility. All but the current season's needles were infected, and the diseased needles were still green. In June, 1946, the infected needles were dead and were being cast. The trees most severely attacked had a very ragged appearance, but did not seem likely to die.

SCHEFFER (T. C.). **The decay resistance of Oak wood.**—*Spec. Release Div. For. Path., U.S. Dep. Agric.*, 13, 6 pp., 1 graph, 1943. [Mimeographed. Received January, 1947.]

The common belief that heartwood of the species comprised for commercial purposes within the red oak group, viz., northern red (*Quercus borealis*), scarlet (*Q. coccinea*), and black (*Q. velutina*), is uniformly low in resistance to decay was confirmed by inoculation tests with three wood-destroying fungi (*Poria, Lenzites*, and *Stereum* spp.) [cf. *R.A.M.*, xxii, p. 333] on the increment cores from trees with a diameter of 15 to 18 in. at breast height in the major oak-producing regions near or east of the Mississippi and in one locality in Oregon. Heartwood of the white oak group, consisting of chestnut oak (*Q. montana*), Oregon white (*Q. garryana*), white (*Q. alba*), and swamp chestnut (*Q. pinus*), proved to be generally more resistant than the red, the chestnut and white in particular giving promise of suitability for service conditions involving high risks of deterioration [cf. ibid., xxii, p. 460]. The upper logs provided rather more resistant heartwood than the lower, and the outer heartwood is markedly superior in this respect to the inner. Oak sapwood should not be used under conditions likely to promote decay.

CHRISTENSEN (C. M.) & MOSES (C. S.). **Molds and bacteria that delaminate plywood bonded with casein and soybean glues.**—*Spec. Release Div. For. Path. U.S. Dep. Agric.* 25, 23 pp., 2 figs., 3 graphs, 1945. [Mimeographed.]

Scopulariopsis brevicaulis and *Penicillium glaucum* were the predominant moulds growing in casein-glued yellow birch plywood. Either of them, in conjunction with the bacteria normally present in the glue and surviving the gluing process, was capable of the rapid delamination of plywood shear specimens (3 by 1 in.) bonded with any of the five casein glues and one soy-bean brand tested. The bacteria alone were also capable of causing complete delamination. Other species exerting a similar effect were *Cladosporium* sp., *Torula* sp., and *Trichoderma lignorum* [*T. viride*], the first-named acting more rapidly than the other two. Exposure to the normal microflora of the air was followed by faster delamination than was induced by inoculation of the specimens with cultures of any of the fungi used. Sodium trichlorophenate (5 per cent.) prevented any weakening of the glued joints either by *S. brevicaulis* or bacteria over a period of 26 days; sodium ortho-phenylphenate (5 per cent.) controlled the latter better than the former. Sodium pentachlorophenate (2 per cent.) also effectively protected two of the casein glues from bacterial action.

KLINKENBERG (CAROLINE H.). **Anatomisch onderzoek van de vergelingsziekte van Bieten, vergeleken met enkele andere Bietenziekten.** [Anatomical study of Beet yellows disease compared with certain other Beet diseases.]—*Meded. Inst. Suikerprod., Bergen-o-Z.*, 2, pp. 33–65, 26 figs., 1946. [English summary.]

An anatomical study at the Institute for Rational Sugar Production, Bergen-op-Zoom, Holland, of sugar beets and some fodder and garden varieties affected by the beet yellows virus [cf. *R.A.M.*, xix, p. 385] showed that the sieve-tube gummosis constantly associated with the disease develops only after the flow of carbohydrates has been arrested, and should therefore be regarded as a secondary effect of the pathological condition of the phloem. Excess of carbohydrates in the leaves is responsible for the chlorosis as well as for a thickening of the texture often developing at the same time.

A second type of necrosis, of obscure origin, is difficult to distinguish macroscopically from that of beet yellows virus, but there are anatomical differences between the two, a conspicuous feature of the former being the very darkly stained necrotic substances in the wood vessels.

Necrotic changes are also characteristic of beets infected by *Verticillium dahliae* [ibid., iv, p. 495], in which dark substances are produced first in the xylem and later also in the surrounding tissues. This form of necrosis is liable to spread to the surface of the petioles and induces the familiar discoloration of the stem base.

The internal modifications herein described afford reliable diagnostic criteria of the three diseases under discussion.

STEVENSON (J. A.). **A leaf-blight of Jack-Bean in Cuba.**—*Plant Dis. Reptr*, xxx, 4, p. 125, 1946. [Mimeographed.]

Examination of jack bean (*Canavalia ensiformis*) leaves collected some years ago in Cuba by the late Dr. J. A. Faris showed the presence of a spotting and blighting of the leaflets sufficient to cause considerable loss of leaf area and even partial defoliation. The spots were at first roughly circular, up to 1 cm. in diameter, and dull brown, with a definite dark border; they soon became irregular and merged together, involving large portions of the leaflets. Finally, they became ashen on both surfaces. The causal organism appeared to be identical morphologically with *Pellicularia filamentosa* [*Corticium solani*].

Arango y Mestre (O.). **Manera de combatir los principales insectos y enfermedades que afectan al cultivo de los Frijoles.** [Mode of combating the principal pests and diseases affecting Bean cultivation.]—*Rev. Agric., Habana*, xxviii, 4, pp. 52–53, 1 fig., 1945.

Directions are given for the control of various bean [*Phaseolus vulgaris*] diseases, including the mosaic virus, mildew [*Erysiphe polygoni*], and rust [*Uromyces appendiculatus*], by means of cultural practices appropriate to Cuban conditions and spraying with Bordeaux mixture, accompanied in the case of the virus by the periodical roguing of infected plants.

Burkholder (W. H.) & Bullard (E. T.). **Varietal susceptibility of Beans to Xanthomonas phaseoli var. fuscans.**—*Plant Dis. Reptr*, xxx, 12, pp. 446–448, 1946. [Mimeographed.]

The bacterial blight of beans, 'fuscous blight' caused by *Xanthomonas phaseoli* var. *fuscans* [*R.A.M.*, xxiii, p. 512], is now common on Michelite pea beans [*Phaseolus vulgaris*] in New York State and is expected to spread to other varieties. It was found once on Marrow beans, and the junior author ascertained that Hidatsa Red, highly resistant to *Pseudomonas* [*medicaginis* var.] *phaseolicola*, is susceptible.

Inoculation experiments under greenhouse conditions on 40 varieties and strains of field and garden beans showed that Great Northern No. 1, which is resistant to *P. medicaginis* var. *phaseolicola* and to the two viruses causing bean mosaic [bean mosaic virus and Southern bean mosaic virus], is also resistant to fuscous blight. This bean is not grown commercially in the eastern areas of the United States, but is valuable for breeding purposes.

Palti (J.). **Downy mildew of Cucumbers and Melons.**—*Hassadeh*, xxvi, pp. 403–404, 1 fig., 1946. [Hebrew.]

Cucumber and melon are the only hosts of downy mildew (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*) so far observed in Palestine, where the disease does not ordinarily appear until mid-June or early July, 25th May being the earliest date on record. The pathogen is most destructive under the conditions of abundant humidity and moderately high temperature prevailing in the coastal plain, in the western part of the Valley of Esdraelon, in the mountains of Samaria, and in parts of Galilee. Overhead irrigation provides an atmosphere conducive to the development of *P. cubensis* and should not be practised where the fungus is rife. On furrow-irrigated plots the disease is most effectively combated by dusting with sulphur [cf. *R.A.M.*, xxiv, pp. 199, 263], the initial application being made a few days after the formation of the first true leaves and the treatments continued weekly until about a fortnight before the end of harvesting. Cucumber and melon powdery mildew [*Erysiphe cichoracearum*] may be simultaneously combated by this programme.

Morwood (R. B.). **Peanut crown rot.**—*Qd agric. J.*, lxiii, 1, pp. 18–19, 1946.

In this account of crown rot disease of groundnuts [*Aspergillus* sp.: *R.A.M.*, xxv, p. 248] it is stated that the fungus enters through lesions in the testa. The disease although causing wilting differs from true wilt [*Fusarium* or *Verticillium* sp.: loc. cit.] in that the root tissues shrink, darken, and become shredded. The depletion of seedling stands is most serious and any check to germination such as adverse moisture conditions, a poor seed-bed, soil deterioration, and particularly successive plantings of groundnuts will promote the development of the seedling blight. Besides the use of treated seed (supplied by the Queensland Peanut Board) suitable rotations with maize, grain sorghums, Sudan grass, or cowpeas are essential, and the inclusion of a three-year Rhodes grass [*Chloris gayana*] sward in each decennial period is desirable.

Reichert (I.) & Chorin (M.). **The high mortality of Groundnuts in 1941.**—*Hassadeh*, xxii, 7, pp. 197–199, 1942. [Hebrew. Received December, 1946.]

Groundnuts in the central coastal plain of Palestine were affected in 1941 by leaf spot (*Cercospora personata*), causing necrosis, desiccation, and defoliation, and two types of root rot, one due to *Sclerotium bataticola* [*Macrophomina phaseoli*: *R.A.M.*, xxiii, p. 187 *et passim*] and the other to a *Fusarium*. The former root-rot pathogen also attacks the stem, while the latter is confined to the underground portions of the roots, whence it spreads to the nuts, penetrating the shell and enveloping the seed in its whitish-violet mycelium. The violet discoloration of the diseased organs is a diagnostic feature of the rot, serving to differentiate it from the blackening caused by *M. phaseoli*. The loss from root rots as a whole is computed at 10 per cent. of the crop.

Bledsoe (R. W.), Harris (H. C.), & Tisdale (W. B.). **Leafspot of Peanut associated with magnesium deficiency.**—*Plant Physiol.*, xxi, 2, pp. 237–240, 1 fig., 1 diag., 1946.

At the Florida Agricultural Experiment Station Dixie Runner groundnut plants in sand cultures developed foliar chlorosis, beginning 24 days after withdrawal of magnesium on the first leaf below the growing tip of the oldest branches; ten days later the condition had spread downwards to the fourth or fifth leaf, while the youngest leaves of all the branches, including the main shoot, were also affected. On the 28th day after the withdrawal of the magnesium, when the plants were 103 days old, a leaf-spotting started on the chlorotic foliage and progressed in the same order as the deficiency symptom; *Mycosphaerella* [*Cercospora*] *arachidicola* [*R.A.M.*, xxv, p. 58] was isolated from the lesions. On the 41st day 3,502 spots were counted on the terminal and 30 on the basal leaflets of the minus-magnesium plants compared with 6 and 15, respectively, on those supplied with a modified form of Hoagland complete nutrient solution (*Circ. Calif. agric. Exp. Sta.* 347, 1938). The magnesium contents of the terminal, central, and basal leaflets of the minus-magnesium plants were 0·012, 0·022, and 0·082 per cent., respectively, of the dry weight, the corresponding figures for those in the complete-nutrient series being 0·307, 0·317, and 0·401 per cent., respectively.

It would appear from these data that magnesium deficiency is either directly or indirectly responsible for the susceptibility of the plants to *C. arachidicola*.

Barss (H. P.). **Conference on Sweetpotato internal cork ; a probable virus disease.**—*Plant Dis. Reptr*, xxx, 11, pp. 418–420, 1946. [Mimeographed.]

In a discussion held at the Edisto Experiment Station, Blackville, South Carolina, on 12th September, 1946, in which all the available information on sweet potato internal cork [*R.A.M.*, xxv, pp. 97, 289; xxvi, p. 145] was reviewed, it transpired that extensive surveys in South Carolina had disclosed no section free from foliage symptoms and no seed stocks that were unaffected. The disease is known to be present throughout North Carolina, is widespread in Georgia, but confined to limited areas, and in Tennessee was found only in one small area, where all the affected stocks have been destroyed.

As a rule, there is no foliage necrosis and no evident reduction in yield, but the corky areas in the flesh, though not affecting the flavour or consistency of the surrounding tissue, are in themselves objectionable. No high percentage of affected plants has so far been found in the general run of commercial crops.

The amount of internal corking present differs greatly with the variety, Porto Rico showing much and Nancy Hall a great deal less. Some varieties show few or no root symptoms, but pronounced foliage symptoms. The cork spots of the roots are permanent and increase in number and area during the growing season and even more during storage.

Transmission by core grafts [cf. ibid., xxv, p. 93] was invariably successful, so that little doubt remains of the virus nature of the condition.

Bosc (M.) & Benezech (C.). **Sur le métabolisme glucidique des ceps de Vigne sains et court-noués.** [On the glucose metabolism of healthy and court-noué Vine stocks.]—*C.R. Acad. Sci., Paris*, ccxii, 26, pp. 1168–1169, 1941. [Received, 1946.]

In June, 1939, analyses of the glucose contents of extracts of healthy and court-noué Aramon and Carignan vine stocks yielded the following values (in gm. per l.): healthy and diseased leaves, 9·5 and 15·1, respectively; healthy and diseased flowers, 6·7 and 4·3, respectively. In a further test in September, 1940, the glucose contents (in gm. per kg.) of healthy foliage, tendrils, and roots before and after protracted hydrolysis at 80° C. were 19·7 and 19·7, 6·8 and 7·4, and 13·63 and 13·70, respectively, the corresponding figures for court-noué material being 29·15 and 30·53, 11 and 11·88, and 7·95 and 7·82, respectively. Thus, the reducing sugar content of the leaves and tendrils is higher, and that of the flowers and roots lower, in court-noué than in healthy vines. The abnormal glucogenesis of the foliar tissues accounts for the attenuation of the symptoms in darkness and their intensification under exposure to the sun's rays, as well as for the heavy fruit yields of diseased stocks, with their large glucose reserves in the tendrils. The 'coulure' [shedding: *R.A.M.*, iii, p. 700] observed at flowering time is also explained by the low reducing sugar content of the floral organs.

Gallay (R.) & Staehelin (M.). **Bouillie bordelaise, oxydules de cuivre et oxychlorures de cuivre dans la lutte contre le mildiou de la Vigne.** [Bordeaux mixture, copper oxides, and copper oxychlorides in the control of Vine mildew.]—*Rev. romande Agric., Vitic., Arboric., 1947*, 1, pp. 3–5, 1947.

Parallel experiments were carried out in three localities, one in each of the cantons of Vaud, Neuchâtel, and Ticino, Switzerland, in 1946 to determine the relative efficiency for vine downy mildew (*Plasmopara viticola*) control of 2 per cent. Bordeaux mixture, 1·5 per cent. copper oxychloride, and 0·5 per cent. copper oxide [cf. *R.A.M.*, xxv, p. 153]. The average efficiency indices (where 100 represents absolute freedom from infection) for the three preparations were 99·4, 97·3, and 96·9, respectively, compared with 0 for the controls. On the basis of these results any of the three fungicides may be recommended for pre-blossom treatments, but Bordeaux mixture is preferable for the later applications unless the risk of infection is slight: if an oxychloride or oxide is to be used, two or three supplementary sprays should be given. The proprietary oxides authorized for use as downy mildew-preventives are cupra colloidal copper, Sandoz copper, Maag copper oxide, and roravit, while the oxychlorides comprise bordofix, bordoxex, coprantol C and cuprenox pastes, Grisard oxychloride, herka oxychloride paste, Rohner oxychloride, cupra 32 and 50 per cent. oxychlorides, oxycuivre, veravit, and viricuivre.

Richards (M. C.). **Spraying Grapes to control black rot.**—*Plant Dis. Reptr*, xxx, 12, p. 464, 1946. [Mimeographed.]

The most serious disease of cultivated grapes in New Hampshire is black rot (*Guignardia bidwellii*) [*R.A.M.*, xxiv, p. 270; xxv, p. 201], unsprayed vines in home gardens often becoming a total loss as a result of infection. Comparative spraying tests in 1946 with Bordeaux mixture (6–6–100), fermate (2–100), zerlate (2–100), and phygon (2,3, dichlor–1,4-naphthoquinone, 1–100), using three applications at 250 to 300 lb. pressure, and adding 50 per cent. wettable DDT (1–100) in the first two, showed that all the materials gave good control of the disease on the foliage but not always on the fruit. Phygon caused slight to severe flecking

of the fruits on all the varieties used. Fruit losses amounted to 10 to 25 per cent. on the Brocton, Van Buren, and Yates varieties, while fruits of Kendaia, Worden, Fredonia, and Geneva seedlings 11987 and 16241 showed only a trace of infection, and Concord seedless, and Minnesota seedlings 45 and 69 none.

PRICE (W. C.). **Measurement of virus activity in plants.**—*Biometr. Bull.*, ii, 5, pp. 81–86, 1946.

The author summarizes some important contributions to the biometrical study of plant viruses, most of which have been noticed from time to time in this *Review.*

PIRIE (N. W.). **The viruses.**—*Annu. Rev. Biochem.*, xv, pp. 573–592, 1946.

The present position of virus research is briefly surveyed in terms of three questions, namely, (1) whether viruses can be considered a group that is chemically and physically distinguishable from all other biological material; (2) whether there are general chemical differences between plant, bacterial, and animal viruses; and (3) the feasibility of virus classification.

It is concluded from a perusal of the relevant literature (listed in a bibliography of 89 titles) that no chemical differentiation of viruses from normal tissue components is practicable in the light of present knowledge; they are recognizable only by their ability to induce definite physiological changes in the host, and not by their own intrinsic properties. It is of interest to note that the viruses are not known to infect gymnosperms, pteridophytes, and bryophytes.

So many factors influence the direction of plant and animal virus research that differences in the results may not reflect genuine divergences between the two virus groups. Parallel studies on the viruses attacking plants, bacteria, and animals should be carried on wherever circumstances permit.

All the classification systems hitherto proposed are open to various objections arising from imperfect knowledge of their morphological, chemical, and physical attributes.

Other sections of the review are concerned with the tobacco mosaic virus, other plant viruses, associations between a virus and its host, and general methods of investigation.

TAKAHASHI (W. N.) & RAWLINS (T. E.). **An electron microscope study of two strains of Potato X virus.**—*Amer. J. Bot.*, xxxiii, 9, pp. 740–742, 1 fig., 1 graph, 1946.

Examined under the electron microscope, Larson's potato virulent ring spot and potato latent mottle viruses [*R.A.M.*, xxiv, p. 244] were found to be indistinguishable in shape and size. The lengths of a high proportion of the particles ranged from 500 to 600 mμ. The particles are apparently flexible, unlike the rigid constituents of the tobacco-mosaic virus [ibid., xxv, p. 476], and are often variously curled. The similarity in appearance of these two strains of potato virus X is in conformity with the view that mutations are not ordinarily accompanied by perceptible changes in the aspect of the virus particles.

WILLIAMS (P. H.), SHEARD (ENID), READ (W. H.), SELMAN (I. W.), & GROSSBARD (E.). **Plant diseases.**—*Rep. exp. Res. Sta. Cheshunt, 1945*, pp. 25–65, 1946.

In the section of this report [*R.A.M.*, xxv, p. 290] dealing with *Verticillium* wilt of tomatoes and cucumbers (pp. 26–31), P. H. WILLIAMS presents experimental evidence indicating that infection of Potentate tomatoes by *V. albo-atrum* was checked by warm, moist conditions and that by *V. dahliae* somewhat less so. High soil moisture somewhat delayed the onset of attack by *V. albo-atrum* but the final intensity of the disease was not reduced. Low temperatures favoured cucumber

(variety Butcher's Disease Resister) infection by *V. albo-atrum*, and cross-inoculations proved that this fungus from tomato can infect cucumber and vice versa.

Work by ENID SHEARD (pp. 31–42) showed that the strain of *Didymella lycopersici* [ibid., xxiv, p. 480; xxv, p. 371] that affects outdoor tomato fruits does not attack the stems of glasshouse plants. Experiments in collaboration with O. B. ORCHARD demonstrated that the spores can be air-borne and were frequently trapped on agar plates both outdoors and in greenhouses. Of various chemicals tested for their ability to kill the fungus spores in the soil, ethyl mercuric phosphate gave 100 per cent. kill at 1 in 20,000 after being in contact with an equal weight of soil for one hour. Mercuric chloride (1 in 500), basic phenyl mercuric nitrate, and basic phenyl mercuric borate (both at 1 in 2,500 to 5,000) were also effective. It was noted that the toxicity of copper compounds to *D. lycopersici* spores was reduced in the presence of tomato juice. Soils treated with mercuric chloride solution (1 in 1,500) retained much of their fungicidal activity after leaching. The surface of soil treated with a 1 in 49 solution of 40 per cent. formaldehyde retained its toxicity to free *D. lycopersici* spores up to seven days after treatment, but lost it after 14, while soils treated with ethyl mercuric phosphate solutions remained toxic for much longer periods. Spores inside pycnidia were not affected by contact with treated soils. Free spores, but not those in pycnidia, were killed by one hour's exposure to formaldehyde vapour produced by adding 4 fluid oz. 40 per cent. formaldehyde to 2 oz. potassium permanganate per 1,000 cu. ft. of house. This method is satisfactory for destroying free spores left in houses after the tomato stems have been removed. A cheaper and equally effective method is to spray the atmosphere with formalin solution (1 in 49) through a fine nozzle at the rate of 1,100 gals. per acre. Spores exposed on slides 24 hours after completion of spraying did not germinate.

Experiments by W. H. READ (pp. 42–46) on the chemical control of *D. lycopersici* showed that when tomatoes were planted in steam-sterilized soil (in a glasshouse) inoculated with the fungus, 31 out of 36 plants became infected. No infection occurred, however, in similar plots treated before planting with 2 per cent. formaldehyde (39·8 per cent. commercial solution) or 2 per cent. tar acid (emulsion containing 41 per cent. phenols) at 1 gal. per sq. yd. Some reduction in infection was given by 0·05 per cent. mercuric chloride solution at ½ gal. per sq. yd. used both before planting and for watering in the plants at the rate of 1 pt. per plant (3 plants infected out of 18); by watering in with malachite green solution 0·065 per cent. solution at 1 pt. per plant (11 infected out of 36); and by treating the soil with malachite green solution 0·065 per cent., 1 gal. per sq. yd., before planting (10 out of 36). A delay of 12 days between treatment and planting in the case of formaldehyde and tar acid may perhaps have influenced the results on these plots.

Work by I. W. SELMAN on tomato virus diseases (pp. 46–55) indicated that unduly heavy dressings of sulphate of potash tended to increase mosaic incidence [ibid., xxiii, p. 45] in Potentate plants inoculated with the yellow strain of tobacco mosaic virus. Evidence also indicated that plants grown with potash at a low level, but not low enough to induce deficiency symptoms, might, in some cases, show resistance to systemic invasion by tobacco mosaic virus. Potash did not appear, however, to be the factor of primary importance in this connexion. In experiments with mixed fertilizers plants receiving 2·5 gm. blood, 10 gm. superphosphate, and 1·25 gm. potassium sulphate per 6-in. pot showed the highest resistance to mosaic. The addition of lime tended to increase susceptibility except where peat was used in the compost. Tree tomatoes (*Cyphomandra* sp.) inoculated with potato virus X developed a regular mottling on some of the lower leaves and on other leaves as they matured. After inoculation with tobacco mosaic, local lesions appeared more rapidly and in greater numbers on *Datura stramonium* (especially on the cotyledons of young plants) than on *D. tatula*. Systemic necrosis, however, tends to develop

rapidly in the latter, often with a fatal result, whereas in the former systemic infection may not occur.

Preliminary studies by E. GROSSBARD (pp. 55–65) showed that *Aspergillus clavatus* was antagonistic to *Bacterium carotovorum* [*Erwinia carotovora*], to a non-virulent strain of *Bact. viridilividum* [*Pseudomonas viridilivida*], and to *Phytophthora cryptogea*, and all were sensitive to pure clavatin. *A. clavatus* grew well on sterilized fresh wheat straw with and without the addition of glucose, and produced an antibiotic, presumably clavatin [ibid., p. xxiii, 267]. The water extracts of this medium after 14 days' growth of *A. clavatus* were active against the same three organisms. The percentages of damping-off of tomato seedlings caused by soil inoculation with *P. cryptogea* were 48·7 and 26·2, respectively, when 30 and 60 gm. autoclaved fresh wheat straw inoculated with *A. clavatus* were incorporated in the soil, and 21·6 and 13·9 with the addition of glucose; percentages in the controls ranged from 84 to 93·6. Little antibiotic was produced when the fungus grew on composted wheat straw.

O. OWEN, dealing with chemical problems (pp. 80–85), adduces evidence showing that three or more sprayings with a 2 per cent. solution of Epsom salts [magnesium sulphate] will prevent yellowing of tomato plants in magnesium-deficient soil; application of the salt as a base-dressing before planting delayed the appearance of the symptoms for three or four weeks and reduced their severity [ibid., xxv, p. 586].

Omission of boron [ibid., xx, p. 554] caused the leaves of Cheshunt Early Grant lettuces to begin to lose colour within ten days. Chlorosis progressed in the older leaves until definite areas were nearly white. The veins retained most of their colour, even when, in many instances, the leaf was almost dead. The heart remained green for some time, but eventually chlorosis and necrosis developed and the plant died. General stunting was well marked and root growth very limited. Omission of iron appeared to have little effect on the roots; there was some foliar crinkling, loss of colour, and development of grey bloom; necrotic areas developed near and upon the midrib, particularly on the upper side near the base. Magnesium omission produced serious stunting of the plant and reduction of the roots. The foliage was pale, especially the lower leaves, on which necrotic areas appeared. The affected leaves were asymmetrical. Manganese deficiency caused stunting, a grey bloom on the lower side of the leaves, and small, well-defined, necrotic spots near the margins. Irregular necrotic areas developed on the midribs, and they were sometimes hollow. There was some distortion and asymmetry.

Station fédérale d'essais viticoles et arboricoles et de chimie agricole, à Lausanne et à Pully. Rapport d'activité 1945. [Report for 1945 on the work of the Federal Viticultural, Arboricultural and Agricultural Chemistry Experiment Station at Lausanne and Pully.]—*Annu. agric. Suisse*, xlvii, 8, pp. 741–842, 1946.

M. STAEHELIN, in charge of the section of physiology and plant protection (pp. 754–769), reports as follows on the various projects undertaken during 1945 [cf. *R.A.M.*, xxv, p. 153]. Thanks to favourable weather conditions, namely, a warm spring permitting early ripening of the winter spores of the fungus and rapid leaf infection, and persistent drought conducive to the subsequent spread of the pathogen through the tissues, *Pseudopeziza tracheiphila* again extended its range, appearing in hitherto unaffected vineyards [ibid., xx, p. 515]. Reasonably good control was obtained in experiments in which the normal spraying schedule (against downy mildew [*Plasmopara viticola*]) was preceded by two applications of 2 per cent. Bordeaux mixture, the first on 26th April and the second on 8th May.

Under suitable environmental conditions grey mould (*Botrytis cinerea*) may occasion heavy reductions in grape yields [ibid., xvi, p. 152], and experiments were accordingly conducted to determine the possibility of its control on the highly susceptible Seibel 5455 variety. Three applications of 0·75 per cent. organol (a

sulphur-containing product), 0·5 per cent. liquid tumex (oxyquinoline) plus 0·2 per cent. M.G. wetter, and tumex dust on 10th and 25th July and 15th August reduced the amount of the rot from 40 to 18, 19, and 33 per cent., respectively, while a degree of protection was also incidentally conferred by insecticidal treatments on the first two dates with 1 per cent. nicotine plus 0·1 per cent. wetter or 0·5 per cent. Bordeaux plus 1 per cent. nicotine and 0·2 per cent. wetter (30 and 27 per cent., respectively).

A 0·5 per cent. tumex solution again gave excellent control of 'coître' (*Coniothyrium diplodiella*) [ibid., xxv, p. 153], both on experimental plots where the grapes were artificially infected and following hail showers in three vineyards. In the former series its efficacy was rated at 91 and in the latter at 89 per cent. in a scale from 0 to 100.

The dry summer of 1945 did not favour the development of apple scab (*Venturia inaequalis*), but spraying experiments in three localities indicated that 'reserve' applications of 6 per cent. carbolineum plus 2 per cent. copper oxychloride on 20th March equalled or excelled the standard dormant treatments followed by a pre-floral application of lime-sulphur.

Equally good control of cherry shot hole [*Clasterosporium carpophilum*: ibid., xxiii, p. 349] was secured in a preliminary trial with a 'reserve' spray of 1 or 2 per cent. copper oxychloride at bud-burst on 21st March as with the standard schedule of 1·5 per cent. lime-sulphur plus 0·3 per cent. copper oxychloride before flowering (4th April), 0·75 per cent. organol or 1 per cent. lime-sulphur plus 0·1 per cent. iron sulphate after petal-fall (5th May), and 0·5 per cent. amarex on 1st June, the percentage of damaged leaves on 19th July ranging from 9 to 12 on the treated trees compared with 40 on the controls.

Peach leaf curl (*Exoascus* [*Taphrina*] *deformans*) proved amenable to dormant treatments of 1·5 per cent. dinitrocresol plus 1 per cent. copper oxychloride. The value of a dormant treatment with 1 per cent. lime-sulphur against plum pockets (*T. pruni*) was confirmed.

In cross-inoculation experiments with *Monilia cinerea* [*Sclerotinia laxa*], the agent of heavy damage to fruit-trees, especially sour cherries, positive results were obtained on (sweet) cherry blossoms in 48, 51, 35, and 50 per cent., respectively, of the tests with conidia from mummified fruits of peach, cherry, plum, and myrobalan [*Prunus divaricata*]. Sour cherry blossoms reacted positively in 50, 46, 48, and 39 per cent., respectively, of the tests with conidia from peach, apricot, plum, and *P. divaricata* mummies. In the case of apricot, however, only one flower out of 400 inoculated in 18 tests with conidia of diverse origins was attacked by the fungus, which penetrated as far as the peduncle.

Bordeaux mixture (1 per cent.) copper oxychloride (viricuivre), and copper oxide (Sandoz copper), applied on 11th June and 16th July, were more effective in the control of walnut anthracnose (*Marssonina juglandis*) [*Gnomonia leptostyla*: ibid., xxii, p. 117] than 1 per cent. lime-sulphur. The numbers of spots per leaf on the copper- and lime-sulphur-treated trees were 13 and 28, respectively, and the percentages of fallen fruits 5 and 31, respectively, compared with 127 spots and 82 per cent. fallen fruits on the controls.

Apricot die-back assumed a severe form in the canton of Valais in 1944 and 1945. The disorder appears to be occasioned usually by wounds of all sorts, the intervention of fungi, notably *Valsa* spp. [including *V. cincta*: ibid., xv, p. 447], apparently being generally secondary.

The following conclusions are drawn from experiments in the disinfection of vegetable seeds against collar and root rots and the like. The copper compounds, copper carbonate, graminon [ibid., xxvi, p. 11], Sandoz copper, and Maag 5367, were generally satisfactory, but in cases of heavy contamination, notably by species of *Penicillium*, their efficacy was much reduced. The mercurials, ceresan,

zyma 3, abavit B, tillantin R, and prosat, were more thorough in their protective action and less dependent on the extent of seed infection. Travacide, a product with an oxyquinoline base, controlled damping-off of sugar beet at 0·1 per cent. (ten minutes' immersion), but not at the recommended 0·05 per cent. In general, the copper compounds do not significantly impair germination or growth, but caused marked injury to the Bon Jardinier and Enfant de Mt. Calme haricot bean [*Phaseolus vulgaris*]. The seeds tested fell into two categories in respect of their reaction to mercury treatments, radish, pea, cucumber, chicory, and haricot beans being tolerant (except that prosat injured the last-named) and lettuce [ibid., xviii, p. 228], onion, cabbage, celery, carrot, and tomato sensitive, especially to ceresan; zyma 3 is non-toxic. Among the yield increases over the controls obtained by seed disinfection were 33, 59, and 51 per cent., respectively, for Nantaise carrot, Best of All tomato, and Romaine lettuce treated with copper carbonate, 100 per cent. for Best of All tomato with Maag 5367, and 31 per cent. for Marmaude tomato (zyma 3).

Steaming was the most effective method of soil sterilization in Viroflay spinach and Reine de Mai lettuce frames, increasing the yields by 77 and 47 per cent., respectively. The dense cropping induced promoted attacks of lettuce mildew (*Bremia lactucae*).

G. Trivelli's studies in the section of anti-parasitic products on the physical properties of the principal types of copper-containing fungicides (pp. 817–821) showed that Bordeaux mixture surpassed all others in adherence and persistence on vine leaves. The adherence of the copper oxides was rated between 66 and 98 per cent. and their persistence at 26 to 33 in a scale where 100 represents the performance of Bordeaux mixture. The corresponding figures for the copper oxychloride dusts were 60 to 95 and 4 to 25 per cent., respectively, and for the same compounds in paste form 36 to 67 and 18 to 27 per cent., respectively.

Eastham (J. W.). **Report of Provincial Plant Pathologist.**—*Rep. B.C. Dep. Agric., 1942*, pp. X53–X59, 1942; ibid., *1943*, pp. R59–R64, 1943; ibid., *1944*, pp. S57–S65, 1944; ibid., *1945*, pp. V66–V71, 1946.

In the first of these reports [cf. *R.A.M.*, xx, p. 5] it is stated that Douglas firs [*Pseudotsuga taxifolia*] all round Kootenay Lake, British Columbia, suffered serious defoliation as a result of infection by *Melampsora albertensis* [ibid., xxv, p. 145]. The disease was also severe sporadically at Kamloops. Though not new to British Columbia, the occurrence of the rust in such a severe epidemic form was unusual. Serious tipburn and leaf-spotting were caused to greenhouse plants in Victoria by coke fumes, fuchsias and calceolarias suffering the most damage.

In the second report a serious outbreak of bean rust (*Uromyces appendiculatus*) [ibid., xx, p. 5] during 1943 in the Matsqui District on Kentucky Wonder is reported, the yield being halved in some fields. The aecidial stage was abundant on 15th July and the uredosori appeared a few days later. Ripening cherries, particularly the Bing and Centennial varieties, in several orchards at Boswell were attacked by twig blight (*Coryneum beijerinckii*) [*Clasterosporium carpophilum*], infection reaching up to 25 per cent. On p. R64 the assistant plant pathologist, W. R. Foster, reports that the Vetomold 121 tomato proved resistant to leaf mould (*Cladosporium fulvum*) [but see ibid., xxvi, p. 8], and had, in 1943, replaced 90 per cent. of greenhouse varieties grown on the coast.

In the 1944 report it is stated that bean rust was less destructive in the Matsqui District than in 1943, but was quite severe though the variety mainly grown had been changed to Blue Lake. Seed from two resistant varieties obtained from the United States gave plants that remained almost unaffected though growing in close proximity to others heavily diseased. Freedom of potatoes from ring rot (*Corynebacterium sepedonicum*) [ibid., xxvi, p. 8] is attributed to quarantine measures, the ring-rot regulations passed in 1942 and 1943, the use of certified

seed, and a publicity campaign. A strawberry crown blight, the cause of which is unknown, caused an estimated loss of 25 to 30 per cent. in the Fraser Valley. The chief symptom was the death in spring of all or most of the foliage, many of the affected plants reviving, however, in July.

In the 1945 report it is stated by W. R. Foster that during the year potato bacterial ring rot was found in the crops of six commercial and three home growers in the Courtenay area. Intensity was low, except in one instance. In August 35,469 peach trees in Osoyoos and Oliver were examined for western X-disease [ibid., xxi, p. 259; xxiv, p. 5]; only 1·4 per cent. were found to be affected although all the varieties grown are susceptible. At least two orchards were seriously affected but commercial production as a whole has not decreased in the area.

Leach (E. W.). **Trinidad and Tobago Administration Report of the Director of Agriculture for the year 1945.**—20 pp., 1946.

In the section of this report [cf. *R.A.M.*, xxiv, p. 7] dealing with plant pathology (pp. 15–17), C. A. Thorold states that during 1945 check blocks of cacao counted in Tobago showed no unusual increase in the incidence of witches' brooms [*Marasmius perniciosus*: ibid., xxv, p. 296], although the control gangs which previously had removed all brooms were withdrawn. The very low incidence of pod infection in Tobago, as compared with the considerable pod losses in Trinidad, was confirmed. Cacao pink disease (*Corticum salmonicolor*) [cf. ibid., xviii, pp. 93, 156] was destructive in the Mausica area, recent plantings of clonal rooted cuttings and budded seedling stocks being seriously affected. There was also much die-back, not attributable to fungi, and *M. perniciosus* was also present. The presence of these three diseases in a block of exceptionally uniform cacao made this site a very suitable one for spraying experiments, which were started in May, maintained for three months, and resumed in September. Fortnightly applications of Bordeaux mixture or bordinette completely controlled pink disease and were associated with a statistically significant reduction in die-back.

The intensive survey of cacao virus disease [ibid., xxvi, p. 48] aided by a grant of $3,500 from Cocoa Subsidy Funds was continued, bringing the total of trees examined in the Santa Cruz Valley to 17,000, of which about 2,000 showed virus symptoms.

Bacterial wilt (*Bacterium* [*Xanthomonas*] *solanacearum*) [ibid., xxiii, p. 327] continues to be the chief limiting factor in tomato cultivation. The causal organism is apparently common in the local soils, the first crop of tomatoes on 'new' land sometimes becoming affected.

In 1940 and 1941 blocks of different trees were planted in two localities in an attempt to find a substitute for Bocare immortelle (*Erythrina glauca*), which is attacked by *Calostilbe striispora* [ibid., xxi, p. 281], as a shade tree for cacao. The evidence so far obtained indicates that *Peltophorum ferrugineum* is a suitable substitute when a high canopy is not required. Where the cacao trees become relatively tall, *Schizolobium excelsum* or *Parkia roxburghii* should be tried. *Bravaisia integerrima* with a less extensive canopy made excellent growth on very wet land, and appears to be suitable.

Other investigations were made into cabbage soft rot (*Bacillus carotovorus*) [*Erwinia carotovora*] and black rot (*X. campestris*), a root disease of rice resembling 'man rice' of British Guiana [associated with *Gibberella fujikuroi*: ibid., xiv, p. 217], and sweet potato black rot (*Ceratostomella fimbriata*).

Science for the Farmer.—*Rep. Pa agric. Exp. Sta., 1945–6* (*Bull.* 480), 65 pp., 17 figs., 1946.

In this report [cf. *R.A.M.*, xxv, p. 253] it is stated that a new phase of cereal black rust [*Puccinia graminis*] has been discovered in Greece by P. Critopoulos

and identified by F. D. Kern and H. W. Thurston, in which the spores usually found on grasses occurred on barberry leaves. This is the first report of such a condition in nature. O. E. Street reports that Pennsylvania R5A tobacco combines resistance to mosaic and black root rot [*Thielaviopsis basicola*] with a high yielding capacity and other desirable characteristics. According to J. W. Sinden it will soon be safe to introduce synthetic compost into the mushroom [*Psalliota* spp.] industry. One large producer is extending his production as a result of the yields obtained in large-scale trials. Finished compost containing 1·8 per cent. potassium, corresponding to an addition of 14 lb. potassium chloride per ton to a mixture of two-thirds maize fodder and one-third straw, gave more mushrooms than a compost containing 1·6 per cent. Adding more potassium had no further effect on yield. Ammonium nitrate may be replaced by calcium cyanamide on an equivalent nitrogen basis. Optimum calcium cyanamide concentration was 30 lb. per ton of dry mixture. Prepared in ricks consisting of 8 tons maize fodder and 5 tons straw, the synthetic compost yielded as well as horse manure. It was easier to handle and cheaper.

In a survey by D. E. H. Frear over 10,000 chemical compounds were found to have been tested for their fungicidal or insecticidal properties. These were studied statistically by means of punch-cards to determine the relation between chemical structure and toxicity, and the results are to appear in book form.

Of 35 nickel-bearing compounds tested by H. J. Miller for fungicidal usefulness, 12 received an A rating as equivalent to Bordeaux mixture.

Milbrath (D. G.). **Bureau of Plant Pathology.**—Ex *Rep. Dep. Agric. Calif., 1945* (*Bull. Dep. Agric. Calif.*, xxxiv, 4), pp. 213–227, 1945.

In this report [cf. *R.A.M.*, xxii, p. 12] it is stated that during 1945 peach rusty spot [ibid., xx, p. 311] was recorded for the first time in California. The discovery of this disease and peach wart [ibid., xxv, p. 566] illustrates the value of even casual surveys. For the prevention of the introduction and spread of virus diseases in stone-fruits inspection of dormant nursery stock is of no avail. Peach trees affected with wart virus develop normally except for the fruit; apricots may harbour the yellow bud mosaic virus [? peach yellow bud mosaic: ibid., xxiv, p. 65], yet show no sign of infection. Mosaic in apricots [? peach mosaic virus: ibid., xx, p. 370] often produces no symptoms until the second year's foliage. It is suggested, therefore, that some means other than visual inspection is necessary for detection of viruses in nursery stock. Rusty spot was found at Beaumont in Riverside County, Acton in Los Angeles County, and Gordon Valley in Solano County, in all cases on five-year-old Rio Oso Gem trees. At Beaumont, about 80 per cent. of the fruit was severely spotted.

Vines of wine grape varieties, particularly Alicante and Carignane, in a 158-acre vineyard near Gilroy, Santa Clara County, showed a mosaic-like condition [ibid., xxv, p. 201] which had been present for some years, consisting of a conspicuous mottling of the foliage accompanied by a general distress of the whole vine. Several hundred vines were affected, mostly in scattered groups.

The Agricultural Commissioner of San Joaquin County continued the campaign for the eradication of chestnut trees affected by blight (*Endothia parasitica*) [ibid., xxii, p. 12; xxv, p. 15] in his area; all chestnut trees in the three infected plantings showing the presence of the fungus were removed, regardless of the degree of infection.

R. C. Baines states that Elberta, Lovell, and Muir peach trees are seriously affected by yellow bud mosaic. The symptoms may affect only certain branches or the entire tree. The virus also affects almonds and apricots but not seriously, apparently, though these may be a source of infection for peaches. Before 1945, the condition was found only in the Winters area, but during that year it was also

noted near Vacanille and Fairfield. In 1944 all the affected trees in two orchards were destroyed. Examination in 1945 revealed one infected tree in one of these orchards and seven in the other. This and the grouping of infected trees suggest that the disease spreads slowly. Experimental evidence indicated that a bacterium isolated from stem cankers on perennial nightshade (*Solanum douglasii*) was a strain of *Corynebacterium michiganense* [ibid., xxiii, p. 414] and when inoculated into tomato plants it showed high pathogenicity.

G. L. Stout states that the Federal, State, and County Co-operative peach mosaic [ibid., xxiv, pp. 237] project was continued for the tenth successive year. For all counties the total number of new cases was 1,062; the figure was below that of any of the previous years and in striking contrast to 1937 [ibid., xvii, p. 798]. There has been no spread beyond the originally infected area. During the ten seasons, 103,120 affected trees have been found on 3,620 properties. Inspection at blossom-time enables the virus to be detected by petal symptoms, an advantage in varieties like Rochester in which leaf symptoms become masked and allow them to escape detection later.

The same writer also states that Pierce's disease of the vine [ibid., xxvi, p. 42] has been found in nearly all counties in which grapes are grown commercially. It is spread naturally by leafhoppers [loc. cit.] but not by the common grape leafhopper *Erythroneura comes*. For some years it has been most prevalent and destructive locally from southern Merced County southwards; it is most heavily concentrated in the southern and central parts of the San Joaquin Valley. The only known method of suppression is the removal and destruction of the affected vines.

Robak (H.). **Det biologiske grunnlag for dannelsen av ondartete svulster hos planter og dyr.** [The biological basis for the formation of malignant growths in plants and animals.]—*Naturen, 1944*, 2, pp. 41–57, 4 figs., 1 graph, 1944. [Received February, 1947.]

This is a summary and discussion of some important contributions made between 1915 and 1942 to the biology and biochemistry of tumour formation in the plant and animal kingdoms, with special reference to the analogies and differences between crown gall (*Phytomonas* or *Pseudomonas* [*Bacterium*] *tumefaciens*) and cancer [*R.A.M.*, xxiii, p. 8 *et passim*; xxv, p. 293].

Office International du Cacao et du Chocolat. Conférence Internationale du Cacao. Londres 1, 2 et 4 octobre 1946. Compte Rendu Officiel. [International Bureau of Cacao and Chocolate. International Cacao Conference. London, 1st, 2nd, and 4th October, 1946. Official Report.]—155 pp., 14 graphs, 1946.

The third meeting of the International Cacao Conference, held in London on 2nd October, 1946, was concerned with research into the prevention of disease, selection of types, replanting, and other matters connected with cultivation (pp. 87–106). Sir H. Tempany outlined the disease and research position in West Africa and the West Indies. In the former country capsid bugs, principally *Distantiella theobroma* and *Sahlbergella singularis*, and swollen shoot unite to form a pathological complex which has already devastated extensive areas in the Gold Coast and also occurs in Nigeria and the adjacent French territories [*R.A.M.*, xxvi, p. 97]. Since 1943 active steps have been taken to combat swollen shoot, and the work of the West African Cacao Research Institute [ibid., xxv, p. 546] then established has demonstrated the efficacy of the timely eradication of diseased trees and the feasibility of replanting devastated areas provided similar measures for the removal of infected material are concurrently adopted.

Witches' broom (*Marasmius perniciosus*) is the limiting factor in cacao production in Trinidad, where it has caused the widespread destruction or decline of the

crop and necessitated the exclusion from cacao cultivation of lands marginally or submarginally adapted to this purpose. The main hope of control appears to lie in the introduction of resistant forms discovered on expeditions to South America and now being intensively propagated with a view to replanting under a scheme of subsidies instituted by the Trinidad Government [ibid., xxiv, p. 140]. Every effort must be made to prevent the introduction of witches' broom into West Africa, in the British territories of which stringent plant quarantine regulations are already in force, while discussions are proceeding with the authorities in the adjacent French and Belgian possessions on the question of mutual collaboration in the matter.

Mr. J. West, Senior Scientific Officer at the West African Cacao Research Institute, gave an account of its organization, functions, and achievements to date, including a brief progress report on the swollen shoot position, of which mention has already been made.

Mr. D. H. Urquhart, Director of Agriculture, Gold Coast, summed up the situation as regards the swollen shoot and its control in the Colony [ibid., xxv, p. 253], where it is estimated that roughly 101,800 acres are affected and an energetic campaign for the elimination of the virus is in progress.

Mr. A. G. Beattie, Director of Agriculture, Nigeria, defined the foremost object of a projected survey of cacao farms as a search for swollen shoot [ibid., xxv, p. 494], while another of its aims is the continuance of propaganda and instruction on black pod (*Phytophthora palmivora*) control.

Professor R. E. D. Baker briefly summarized the present situation in respect of the selection of high-yielding cacao strains for Trinidad and Grenada referred to above, and made a few observations on the mild virus disease recently detected in the former island [ibid., xxv, p. 296] and on witches' broom.

Guyot (A. L.), Massenot (M.), & Saccas (A.). **Considérations morphologiques et biologiques sur l'espèce Puccinia graminis Pers. sensu lato.** [Morphological and biological considerations on the species *Puccinia graminis* Pers. *sensu lato*.]—*Ann. Éc. Agric. Grignon*, Sér. 3, v, pp. 82–146, 1945–1946.

This is an expanded account of work already noticed from another source [*R.A.M.*, xxv, p. 389].

McKay (R.) & Loughnane (J. B.). **Observations on Gibberella saubinetii (Mont.) Sacc. on cereals in Ireland in 1943 and 1944.**—*Sci. Proc. R. Dublin Soc.*, N.S., xxiv, 2, pp. 9–18, 1 pl., 1945. [Received December, 1946.]

During the spring of 1943, failures of wheat brairds, due to the use of seed infected by *Gibberella saubinetii* [*G. zeae*: *R.A.M.*, xxii, p. 349], were rather common in Eire, particularly in the February, March, and April sowings. Many ungerminated grains from affected fields were permeated with the fungus while the plants were small and chlorotic, with poorly developed root systems. Many of the roots were brown and rotting, and some of the seedlings were dead or dying. Inoculation of these plants under warm, moist conditions usually caused conidia of *G. zeae* to develop. Seedling blight of wheat was present in 1943 in the counties of Limerick, Clare, Westmeath, Offaly, and Dublin, and this phase of the disease is also one to be reckoned with, particularly after wet years when scabbed wheat (i.e., wheat bearing ascospores of *G. zeae*) has been prevalent. Plants killed by seedling blight may cause infection of remaining plants, resulting in ear blight. Samples of scabbed plants were received from ten counties, of which Mayo, Monaghan, Meath, Dublin, Kilkenny, and Waterford were new records for the perithecial stage. There was no record of any serious reduction in yield from the ear-blight and scab stages. One sample of barley was received which was heavily infected with the perithecial stage, this being the first record of scab on barley in Ireland.

In the spring of 1944, only one case of seedling blight due to *G. zeae* [on wheat] was identified, the affected specimens coming from Co. Monaghan. Wheat ears with perithecia were received from nine counties, Donegal being a new record, and bringing the total for the past three years to 17. Specimens from three counties showed only the *Fusarium* stage, but perithecia in many cases developed (on the stems) when the culms were cut and placed in water at room temperature.

When healthy and infected wheat grains were sown together in pots of sterilized soil in an unheated greenhouse the infected did not germinate, whereas all the healthy grains gave normal plants, and there was no evidence of fungal spread in the soil. On 6th April, 1943, a nine-day-old culture of *G. zeae* was mixed with the top 2 in. of sterilized soil in pots. They were sown with 240 grains of Queen Wilhelmina wheat surface-sterilized for five minutes in mercuric chloride solution (1 in 1,000). Of the 232 plants which appeared, after six weeks 64 per chlorotic and 6 had died from a severe root rot. The dead seedlings produced perithecia and ascospores. The chlorotic plants recovered, but later on *G. zeae* was readily obtained from dark brown areas in their outer leaf sheaths near soil-level. Later, these plants were attacked by *Erysiphe graminis*. Examination of dead tillers in October showed the basal parts to be completely rotted, perithecia of *G. zeae* being present on these and other tillers, the heads of some of which produced no grain, their bleached ears resembling those of plants affected by *Ophiobolus graminis*. Controls in uninoculated, sterilized soil remained healthy.

On 10th June, 60 grains each of Pajbjerg and Desprez wheat were sown in pots of sterilized soil, which were then sprayed with an ascospore suspension of *G. zeae*. No seedling blight developed, though the plants became attacked by *E. graminis*. The bases of several of the plants in October bore perithecia of *G. zeae* although no symptoms had been apparent previously.

In July, 200 grains of each of the wheat varieties Atle, Pajbjerg, and Queen Wilhelmina steeped for 30 minutes in an ascospore suspension of *G. zeae* were sown outside, the grain being sprayed with the spore suspension before it was covered over with soil. No sign of infection appeared. At heading out, however, the number of heads in the inoculated Atle row was considerably less than in the control row, and by the end of September some of the tillers were dead. The rotted basal parts produced perithecia and ascospores after incubation.

Other experimental evidence indicated that soil which has produced diseased plants does not retain its infectivity until the following season, even when the remains of infected plants are added to it. The fungus also grew freely, under incubation, on the anthers of wheat plants sprayed with an ascospore suspension just before and during anthesis.

During August, in the centres of six of ten bundles of healthy wheat heads badly infected heads were placed. Four of the six and two without infected heads were frequently sprayed with water over a period of three weeks. After 45 days, in bundle 1 (heads green and in flower when diseased ears were inserted; sprayed) some of the originally healthy heads in contact with the diseased ones were affected and bound together by a weft of mycelium. No grain formed in the affected or healthy heads. In bundle 2 (heads ripe at inoculation; sprayed) a number of heads in contact with diseased ones were joined to them by a mycelial weft, and some grains in the newly attacked heads were infected. In bundle 3 (heads slightly green, grain well formed at inoculation; sprayed) the heads in contact with affected ones had become attacked, and the grains were shrivelled. In bundles 4 (heads nearly ripe, grain well formed at inoculation; sprayed), 5 and 6 (uninoculated heads; sprayed) 7 and 8 (inoculated and kept dry) and 9 and 10 (not inoculated but kept dry) healthy plants developed no infection.

Perithecia forming on the bases of plants which recover from seedling blight are a source of infection. High atmospheric humidity is necessary for the development

of ear blight, and if it coincides with the flowering period of the host, then the greatest damage is done. As wheat ripens, the ears become more resistant, but infection may spread in stooks if sufficient moisture is present. Abundant moisture is also essential for perithecial development.

Semeniuk (W.). **Chromosomal stability in certain rust resistant derivatives from a T. vulgare × T. timopheevi cross.**—*Sci. Agric.*, xxvii, 1, pp. 7–20, 1947.

The need is pointed out for the production of a range of wheat varieties resistant to the constantly mutating strains of *Puccinia graminis tritici*. For this study F_5 and F_6 material selected in Australia from a cross between *Triticum timopheevi* and Steinwedel [*R.A.M.*, xix, p. 78] was used. The two species have different chromosome numbers and the object was to examine chromosomal behaviour in these lines, the original parents, and six commercial varieties, and to attempt to combine stability with resistance. Abnormalities in meiosis were analysed from anther smears, and rust resistance was measured by the degree of infection resulting from exposure to some 30 prevalent races of *P. graminis*.

Chromosome stability appears, from the correspondence between the percentage of meiotic abnormalities in parents and offspring, to be inherited. The winter strains derived from the original cross showed greater instability than the spring strains, but it was found possible to select lines among the progeny which combined chromosomal stability with rust resistance and other desirable characteristics. These lines appeared to be homozygous for leaf [brown] rust [*P. triticina*] resistance, but heterozygous for resistance to stem [black] rust. Line numbers 996 and 1011 were resistant to black rust, showed only a trace of brown rust, and had only 1·6 and 1·9 per cent. abnormal pollen, respectively. It is considered that the percentage of pollen abortion will be a useful guide to the breeder in enabling him to eliminate unstable lines.

Cherewick (W. J.). **A method of establishing rust epidemics in experimental plots.**—*Sci. Agric.*, xxvi, 11, pp. 548–551, 1 fig., 1946.

A stock of uredospores of the cereal rust [unspecified] is obtained by growing susceptible host plants, three or four together, in a 6-in. pot. At the short-blade stage they are dusted with a mixture of spores and talc (1:10) from a scent-spray type of duster, sprayed with a fine mist of water, and transferred for 24 hours to a chamber thoroughly wetted inside and out at a temperature of 10° to 15° C. They are then returned to a moderately cool greenhouse, and the spikes are removed as they appear. When the sori develop, spore collections are made every two or three days by tapping the plants over a smooth sheet of paper, 100 pots yielding over 400 c.c. spores. These dry spores can be stored at a temperature of 0° to 3° for as long as twelve months.

Field inoculations are made by dusting plants in the third or fourth leaf stage, using the same duster on a long handle and the spore-talc mixture. The talc provides nuclei for the condensation of moisture, giving a large number of small droplets over the leaf surface, instead of the natural few large drops on the margin, and favours the germination of the spores. Heaviest infections were obtained when inoculations were made on still evenings as the dew began to form.

Glynne (Mary D.) & Moore (F. Joan). **Eyespot and lodging of Wheat.**—*J. Minist. Agric.*, liii, 7, pp. 305–308, 2 pl., 1946.

During 1946, wheat lodging [cf. *R.A.M.*, xxiv, p. 184] was much worse than usual in southern England, but while much was due to luxuriant growth and inclement weather, crops weakened by eyespot (*Cercosporella herpotrichoides*) [ibid., xxv, p. 301] were often laid flat when heavier, but unaffected, crops remained standing. Eyespot has almost certainly increased in recent years and is expected to become

worse with the extended cereal cropping at present necessary. The disease increases with the frequency with which wheat and barley are grown on the same land [ibid., xxvi, p. 50].

The first wheat crop after grass generally shows little or no eyespot. At Rothamsted the second wheat crop after grass is also very little affected, but the third shows about 20 per cent. infected straws; this does not cause appreciable loss, but it may carry severe infection to the next crop. The rate at which the disease increases in different seasons and localities depends largely on the amount of moisture present.

Rotations with non-susceptible crops for at least two years are recommended. Good wheat crops can, however, usually be grown on infected land if one or more of the following conditions obtain: the season is dry, the land is well drained, short-strawed varieties, e.g., Jubilegem, are sown and properly manured, thin sowing is practised and weed control carried out, or when infected crops on fertile land are sprayed with sulphuric acid in early spring.

Gorter (G. J. M. A.). **Wheat stunt—a new cereal disease.**—*Fmg S. Afr.*, xxii, 250, pp. 29–32, 44, 4 figs., 1947.

In September, 1945, the author observed in the Transvaal stunted wheat plants with narrow, yellowish-green or chlorotic streaks along the leaf veins, a condition long known to the farmers as 'kroeskoring' ['curly grain']. The first streaks appear near the base of the second or third leaf, and on succeeding leaves cover a progressively larger area, until the whole length shows parallel rows of streaks. The streaks are generally about $\frac{1}{100}$ in. wide and from $\frac{1}{100}$ to $\frac{1}{8}$ in. long. In severe attacks they joined to form longer lines parallel to the veins. Fully streaked leaves were mostly very short and often showed bent or curled tips. The haulms remained short, but tillering was stimulated, with the result that affected plants were small and bunchy. Dwarfed plants gave only a few heads, and these were about half the normal length with only isolated grains or no seed. Bearded varieties generally showed some bent awns. Plants infected at an early age sometimes died prematurely. As a rule the affected plants were scattered about the fields.

Greenhouse tests showed that the condition, termed 'wheat stunt', was caused by the A form of the maize-streak virus (nomenclature of A. P. D. McClean in 'Some forms of streak virus occurring in maize, sugar-cane, and wild grasses': *Sci. Bull. Dep. Agric. S. Afr.*, in press) and transmitted by the leafhopper *Cicadulina mbila*. It is not seed-borne. So far the disease has been found only in areas where maize streak is known to be present, i.e., Lydenburg, Middelburg, Pretoria, Brits, and Rustenburg.

Of the wheat varieties tested, only Renown 461 and 723, Reward 632 and 546, Marquis 489, and Regent 580 appeared to be immune, though Bossiesveld 430 and Renown 570 showed only 0 to 15 per cent. infection.

The disease is particularly severe in early-sown and irrigated wheats. Wheat farmers in the bushveld areas and the 'bankenveld' are advised not to grow maize as a summer crop. If planting some maize for local use is unavoidable, the streak-tolerant Barberton strain of Hickory King should be used. Ploughed lands should be fallowed and cultivated clear of wild grasses before being planted with wheat. Flooding immediately after ploughing should cease. As the immune varieties are not very suitable for the Transvaal it is recommended that early wheat should be sown more thickly than usual, to minimize loss.

Brodie (H. J.) & Jones (J. F.). **The effect of changes of air pressure upon the germination of conidia of Barley powdery mildew.**—*Canad. J. Res.*, Sect. C, xxiv, 6, pp. 318–329, 4 diags., 2 graphs, 1946.

In a previous study on the germination in dry air of the conidia of *Erysiphe graminis hordei* [*R.A.M.*, xxv, p. 280] it was noted that atmospheric pressure had

some effect on germination. Consequently an apparatus was devised to study the effect of variations in pressure under controlled conditions. Two glass germination chambers were kept at a constant temperature of 18° C. by immersion in a cold water bath, and given the same conditions of light and humidity. One chamber was connected either to an aspirator or an air pump; the other was kept at atmospheric pressure. In each test fresh conidia were collected by shaking host plants infected with *E. graminis* race 8 over glass slides lying in a bell jar. Three slides were placed in each chamber, and the pressures set. At the end of three hours the spores were fixed, and the percentage germination recorded. The effect of pressure on the time taken in germination was observed microscopically by waxing inverted slides bearing spores on to two glass chambers, in one of which the pressure was regulated as before.

It was found that a reduction in pressure of not more than 200 mm. mercury increased the percentage of germinating spores, the maximum occurring at the 125 mm. below normal. A depression of between 250 mm. and 500 mm. caused a decrease to 90 per cent. of the normal, and further reduction caused a proportional decrease in germination down to nil in the region of 700 mm. below normal. This change of effect was regarded as due to the inadequacy of oxygen at the reduced pressures. Increase in pressure, while decreasing germination, gave no regularity in the results. Although more conidia germinated at low pressures than at atmospheric pressure in a three-hour period, after five hours the percentage germination was approximately the same in both. The authors suggest that rarefaction facilitates the elimination of carbon dioxide from the spore, which is an essential preliminary to germination.

Guyot (A. L.). **Études expérimentales sur les Uredinées hétéroïques réalisées au Laboratoire de Botanique de l'École Nationale d'Agriculture de Grignon (Seine-et-Oise) au cours de l'année 1944.** [Experimental studies on the heteroecious Uredineae conducted at the Botanical Laboratory of the National School of Agriculture, Grignon (Seine-et-Oise), during the year 1944.]—*Ann. Éc. Agric. Grignon*, Sér. 3, v, pp. 30–32, 1946.

With teleutospores of *Puccinia simplex* [*P. hordei*] collected on barley at Grignon in the summer of 1943 [*R.A.M.*, xxv, p. 389] and overwintered out of doors, the writer successfully inoculated *Ornithogalum umbellatum* [ibid., xx, p. 353] on 18th April, 1944, spermagonia appearing on the 26th, and aecidia maturing on 17th May. Two-rowed barley (*Hordeum distichum*) and winter barley reacted positively to inoculation with the resultant aecidiospores (uredospores erumpent on 31st May), but *H. murinum* was not attacked.

Positive results were obtained in tests at the same time with teleutospores of *Puccinia baryi* (Berk. & Br.) Wint. from *Brachypodium silvaticum* on barberry, and with probasidia of *P. graminis* from *Agropyron repens* on barberry, the aecidiospores produced on which attacked *A. repens* and rye with moderate severity and *A. caninum* mildly, but were innocuous to oats, wheat, and barley. All these collections were made in Eure-et-Loir.

Infection also developed on *Rumex crispus*, *Ranunculus bulbosus*, and *R. repens* inoculated with rusted straw of *Phragmites communis* from Seine-et-Oise; aecidia were formed on the first-named only. Microscopic examination of the straw also revealed probasidia of the *Puccinia phragmitis* [ibid., xxiii, p. 420] type.

Hagborg (W. F.). **Investigations on grey speck of Oats in Manitoba.**—Abs. in *Phytopathology*, xxxvii, 1, p. 8, 1947.

Pot experiments in 1944 confirmed the presence of grey speck [manganese deficiency] of oats in Manitoba [*R.A.M.*, xxiii, p. 99], and in subsequent field trials the application of manganese sulphate to the soil at the rate of 65 lb. per acre

resulted in an increased yield of 58 bush. per acre, the corresponding figures for application as a spray (9 lb.), as a 25 per cent. dust diluted with clay (8 lb.), and as a seed steep (9·5 lb.) being 24, 20, and 12 to 17 bush. per acre, respectively. In a replicated trial of 68 varieties in 1946, *Avena strigosa*, Black Mesdag, Ajax, Exeter, and Laurel were among the more resistant, while Victoria, Tama, Vicland, Bonda, Early Miller, Valor, Sixty-day, Erban, Trispernia, Mindo, Legacy, and Bond were susceptible. Varieties descended from Victoria showed a high degree of susceptibility, which is not fully linked, however, with resistance to stem and crown rusts [*Puccinia graminis avenae* and *P. coronata*, respectively].

Rapin (J.). **Les charbons de l'Avoine.** [The smuts of Oats.]—*Rev. romande Agric., etc., 1947*, 1, pp. 1–3, 2 figs., 1947.

The economic importance of the loose and covered smuts of oats (*Ustilago avenae* and *U. levis* [*U. kolleri*]) is commonly underrated in Switzerland, where the crop reduction from these pathogens (chiefly the former) often amounts to 25 per cent. or so. In 1945 numerous fields were disqualified for seed production on account of their high proportion of smutted plants. From one such field in the canton of Neuchâtel, a batch of Pluie d'Or seed was procured for experimental purposes and sown on 1st April, 1946, after various treatments. On 28th July, the incidence of infection in the plots from seed immersed for 15 minutes in 1 per mille formalin or for 10 in hot water (53° C.) was nil, compared with 2·7, 1·4, 0·4, 1·9, 3·1, and 3·5 per cent., respectively, in those dusted with copper carbonate, zyma 3, ceresan, abavit, prosat, and graminon, respectively, and 4·2 per cent. in the control.

There was no significant reduction in the germinative capacity of seed immersed for ten minutes in water heated up to 53° (94 per cent. compared with 100 for the untreated), but at 55°, 60°, and 70° it sank to 80, 41, and 0 per cent., respectively. Exposure to dry heat at 70° did not materially impair germinability (92 per cent.), but the fungicidal efficiency of this process has not yet been tested.

Nagel (C. M.) & Semeniuk (G.). **Some mold-induced changes in shelled Corn.**—*Plant Physiol.*, xxii, 1, pp. 20–33, 4 graphs, 1947.

Pure cultures of nine fungi, namely, *Aspergillus flavus*, *A. candidus*, *A. niger*, *A. amstelodami*, *Penicillium palitans*, *P. chrysogenum* I and II, *P. rugulosum*, and *Mucor racemosus*, isolated from naturally moulded stored maize [*R.A.M.*, xxiv, p. 364] at the Iowa Agricultural Experiment Station, were grown for four weeks in the laboratory on steam-sterilized maize initially adjusted to a 32 per cent. moisture content. Analyses were made at weekly and bi-weekly intervals for modification in the amounts of water, organic matter, fat acidity, hydrogen-ion concentration, and water-soluble and -insoluble nitrogen. Seven of the moulds (*M. racemosus* and *A. amstelodami* failed to develop) were also grown on Czapek-Dox liquid medium to compare their carbohydrate-utilizing and acid-producing properties on this substratum with the changes they caused in maize.

P. chrysogenum I and II, *A. niger*, and *A. flavus* were the most active decomposers of maize organic matter, the losses due to these organisms within the month covered by the investigation ranging from 40 to 50 per cent. On Czapek-Dox the same fungi were initially the most rapid utilizers of glucose.

A positive linear correlation was established between the percentage loss in organic matter and the percentage of water (wet weight basis) in the mouldy maize. A 1 per cent. decrease in organic matter resulted in a 0·55 per cent. increase of water. The ratios between these two variables were 1:0·701 and 1:0·601 at the two- and four-week periods, respectively, of fungus development.

Fat acidities in the maize were increased by all the moulds tested, especially by the four above-mentioned, rapid decomposers of organic matter and by the slowly acting *M. racemosus* and *A. amstelodami*.

Linear correlations were observed at the early stage of fungus development, but not later, between the losses of organic matter and the changes in the amounts of water-soluble and insoluble nitrogen.

General agreement between the pH and (*a*) fat acidity of mouldy maize and (*b*) titratable acidity of Czapek-Dox medium was obtained with the several fungi.

Semeniuk (G.) & Wallin (J. R.). **The influence of climate on four leaf parasites of Zea mays in Guatemala.**—Abs. in *Phytopathology*, xxxvii, 1, p. 20, 1947.

Maize from the lowlands, highlands, and mountainous regions of Guatemala was planted in six parts of the country at altitudes between sea-level and 8,200 ft., with climates ranging from tropical to temperate, rainfall from 40 to 150 in., and maize maturity from three to nine months. Rust (*Puccinia sorghi*) [*P. maydis*] was the most prevalent and severe disease at 100, 4,900, 5,000, and 8,200 ft. above sea-level, and leaf blight (*Helminthosporium turcicum*) at 4,200 and 5,000. *Angiopsora zeae* [*R.A.M.*, xxiii, p. 316] occurred to a moderate extent at 3,200 ft. and in traces at 4,200, 4,900, and 5,000. *Phyllachora zeae* [*P. maydis*: ibid., xxi, p. 99] was present chiefly on the early maturing varieties in small amounts at 3,200 and 4,200 ft. and in traces at 5,000. The mountain maize maintained its resistance to rust at 8,200, 5,000, and 4,900 ft., but failed at 100. Late highland maize was severely rusted at 100, moderately at 8,200, and slightly at 5,000 and 4,900 ft., while the early ripening lowland types sustained heavy damage at 8,200, 4,900, and 100 ft. and a limited amount at 5,000. Two maizes proved highly resistant to *H. turcicum*.

Goidànich (G.) & Scardovi (V.). **Behaviour of Sphacelotheca sorghi, causal agent of covered smut of Sorghum, on sweet Sorghum cultivated in Italy.**—*Int. Bull. Pl. Prot.*, xx, 11–12, pp. 102M–104M, 1946.

Some concern was experienced in Italy about ten years ago as to the advance of the covered smut (*Sphacelotheca sorghi*) of sweet [saccharine] sorghum, which is widely cultivated for industrial purposes [*R.A.M.*, xviii, p. 517] and may sustain reductions of 30 to 40 per cent. of the crop from the disease.

Investigations in 1939–40 showed the Atlas variety to be the most susceptible of the 22 tested for their reactions to the pathogen, with 36, 40·5, and 24 per cent. infection, respectively, in two crops of the former and one of the latter year, Hasting, Honey, Japanese Ribbon, and Rosso Lombardo were resistant with 2, 1, and 0; 1, 1, and 4·4; 1, 6, and 2·4; and 3, 3, and 3·8 per cent., respectively, and several others, including Orange, Kansas, Planter, and Vienna, intermediate in their responses.

The influence of mineral fertilizers on the development of the smut was very variable: calcium cyanamide and superphosphate reduced the incidence of infection, while nitrates exerted no effect. Early sowing checked the appearance of the symptoms. Refractometric analysis of the ripe cane did not reveal any difference between healthy and diseased plants, but the weight of the latter was less than that of the former owing to stunting.

Reuther (W.) & Crawford (C. L.). **Effect of certain soil and irrigation treatments on Citrus chlorosis in a calcareous soil : I. Plant responses.**—*Soil Sci.*, lxii, 6, pp. 477–491, 3 figs., 1946.

In the spring of 1942, two-year-old Marsh grapefruit trees were set out in a split-plot design on a friable, calcareous soil in the Coachella Valley, California, for the purpose of evaluating the effect of various soil treatments and two moisture-levels on the prevalence of foliar chlorosis [*R.A.M.*, xvi, p. 313; xxvi, p. 102].

A striking interaction of season and moisture-levels was observed. During the summer the disorder was virtually absent from all the plots, irrespective of the amount of moisture supplied, but in the winter and early spring of 1943 it increased very markedly in the wet plots (irrigated with 2 to 3 acre-inches of water at weekly intervals throughout the summer and every two or three weeks in the winter months) and only slightly in the dry ones, receiving the normal amount of moisture, i.e., 2 to 3 acre-inches at two- to three-weekly intervals during the summer of 1942, every four to six weeks in that of 1943, and with a lapse of six to eight weeks between each treatment in the winter.

As regards the soil treatments, trees treated with a very heavy application of triple superphosphate (20 lb. per subplot, containing holes 6 by 4 by 2 ft. each planted with two trees), induced symptoms strongly suggestive of zinc deficiency [ibid., xxv, p. 559], which persisted even in the summer of 1943 at both moisture-levels. In no other treatment did this leaf pattern predominate. Very heavy applications of sulphur (60 lb. per subplot) resulted in poor growth, diminutive leaves, and foliar symptoms suggestive of salt toxicity. The admixture with the soil of chopped lucerne hay (80 lb. per subplot) greatly stimulated the growth of the trees and somewhat reduced the incidence of winter chlorosis.

Ehmke (H. F.). **Hot water immersion of Oranges to detect minute stings.**—*Fmg S. Afr.*, xxi, 249, pp. 838–842, 846, 1946.

A simple new method for the detection of minute punctures in the skins of oranges, which provide openings for decay, has been used with success in one or two large stations and can be adopted by those which have washing plants. After sorting and bleaching the fruit is washed in a hot bath. During this washing process the air inside the orange expands and in punctured fruits emerges as a stream of fine bubbles. The baths used were about 8 ft. by 4½ ft. The oranges were plunged into the water from a slatted conveyer, paddled slowly across the bath, and taken out at the far side on a second conveyor. They remained in the water for about three minutes, floated across about three deep, and the source of any bubbles could be easily traced. The bath needs to stand in a good light, and the water should be as little disturbed as possible. The temperature of the bath must be carefully regulated and not allowed to scald the fruit; 43° to 47° C. gave good results, causing bubbling at about the middle of the bath. As an indication of the success of the method it was found that of the punctured fruit taken from the bath at one station 21·47 per cent., and at another 37·42, would have escaped detection by the usual examination. Buttonless fruits will not bubble unless a minute portion of the rind is removed and there is a distinct decrease in bubbling from wilted fruits.

Venkatarayan (S. V.). **Diseases of Coffee.**—*Mysore agric. J.*, xxv, 1–2, pp. 3–20, [1947].

The diseases affecting coffee in Mysore are listed, with notes on their economic importance, etiology, geographical distribution, host range, the life-histories of the causal organisms, and control.

Hendrickx (F. L.) & Lefèvre (P. C.). **Observations préliminaires sur la résistance de lignées de Coffea arabica L. à quelques ennemis.** [Preliminary observations on the resistance of strains of *Coffea arabica* L. to certain enemies.]—*Bull. agric. Congo belge*, xxxvii, 4, pp. 783–800, 1946.

The chief fungi attacking coffee at Kivu, Belgian Congo, are *Nematospora coryli* [*R.A.M.*, xxiii, pp. 63, 431], *Glomerella cingulata* [ibid., xxiv, p. 412; xxv, p. 154], *Cercospora coffeicola* [ibid., xix, p. 329], and *Botrytis cinerea* f. *coffeae* [ibid., xx, p. 60]; physiological die-back also occurs.

In a comparative study of the losses caused by different diseases on 20 lines growing in the selection gardens a specially trained team gathered at regular intervals before the ripe fruit was picked all diseased 'cherries' on and below the trees. These were classified in the field according to the most striking external symptoms. Trees killed by die-back were counted. At the beginning, middle, and end of harvesting selected berries were de-pulped by hand in the laboratory and the beans classified as floating, black, insect-punctured, discoloured, and healthy. The beans in the first four classes were then examined microscopically and placed in two categories as showing the presence or absence of the ascospores of *N. coryli*. In all, from 1939 to 1944 (excluding 1940), 1,108,308 fruits were examined.

The results obtained show that as regards fruit infection by *G. cingulata* the best results among the local strains were given by Local Bronze (e.g., L.B. 8, 4·23 per cent. average yield loss; L.B. 12, 4·89 per cent.); Kabare 16 was intermediate, with 12·6 per cent. loss. Among introduced strains, Jackson was the best (4·53 per cent.). The Mysore and Bourbon strains proved extremely susceptible and are not recommended for localities where this disease prevails. With regard to *C. coffeicola*, the local strains (Mibirizi, Local Bronze, Bourbon mayagese, and Kabare) were the best (0·37 to 5·91 per cent. loss), apart from Jackson (1·24). As regards die-back on the fruit the differences were inconclusive; mortality counts in the trees showed Local Bronze to be markedly resistant. Damage due to *B. cinerea* f. *coffeae* occurred only in 1939, and very slightly in 1944. The results of the laboratory examination of the 20 strains showed that of the 5,406 beans floated, some completely empty and others only partially so, 73 per cent. were parasitized by *N. coryli*, of 5,336 discoloured (black) beans 86 per cent. were infected, and among the 5,540 insect-punctured and discoloured beans 40 per cent. showed attack by the same fungus.

Thirumalachar (M. J.) & Narasimhan (M. J.). **Studies on the morphology and parasitism of Hemileia species on Rubiaceae in Mysore.**—*Ann. Bot., Lond.*, N.S., xi, 41, pp. 77–89, 15 figs., 1947.

On the basis of the morphology of the sori and cross-inoculation experiments an attempt has been made to distinguish the various species of *Hemileia* occurring on Rubiaceae in Mysore, to which particular importance attaches in view of their potential role in the spread of coffee leaf rust (*H. vastatrix*). The prevalent confusion in the identity of the group is attributed to the close similarity in the shape of the uredospores, the dimensions of which have served as the sole criterion in the differentiation of the species. In addition to *H. vastatrix*, the species used in the studies were *H.* (*Uredo*) *gardeniae-thunbergiae* on *Gardenia thunbergia* [*R.A.M.*, xiv, p. 304], *H. thomasii* n.sp. on *Randia uliginosa*, *H. woodii* on *Vangueria spinosa* [cf. ibid., vi, p. 258], and *H. canthii* [ibid., xxii, p. 74] on *Plectronia parviflora* and *P. rheedii*.

The teleutospores of the foregoing species are mostly subglobose to spherical and (in the case of *H. vastatrix*) [ibid., iii, p. 647] napiform, but *H. woodii*, *H. canthii*, and *H. gardeniae-thunbergiae* also produce other shapes, such as falcate and triangular tridentate, which have never been observed in the coffee leaf rust. In all species they germinated readily *in situ*, producing basidiospores. The view that these organs are functionless cannot be unreservedly accepted. At present the genus *Hemileia* comprises only hemi-forms because of ignorance of the life-cycle, but basidiospore inoculations indicated that none of the species under observation is autoecious. There is some evidence that *H. vastatrix* oversummers in the uredo stage and does not depend on the teleutospores for the accomplishment of its life-cycle. It is concluded that the various species of *Hemileia* are distinct from one another and those on other genera are incapable of passing on to coffee.

KNAFF (E. E. A.). **Étude du shedding dans les cultures cotonnières du Bas-Uélé pendant la campagne 1945.** [A study of shedding in the Cotton plantations of the Bas-Uélé area during the 1945 season.]—*Bull. agric. Congo belge*, xxxvii, 4, pp. 813–816, 1946.

A study of cotton 'shedding' [*R.A.M.*, xv, p. 147] in the Belgian Congo, carried out in 231 fields in different parts of the Buta and Aketi areas, with particular reference to the effect upon the condition of cultural practices and attacks by insects and fungi, showed that shedding is primarily of physiological origin, though phytopathological factors may preponderate. Date of sowing affects the condition in the sense that as the plants age shedding increases more rapidly than boll formation, so that production depends on the first-formed bolls [cf. ibid., xv, p. 719]. Soil factors vary in importance; as a rule, fallows of more than eight years are indicated. In clay soils thickly planted crops are least affected, while in sandy soils the reverse holds. In conclusion, it is pointed out that these observations only apply, for the present, to 1945, and it is hoped to carry out further research along the same lines.

KNIGHT (R. L.). **Breeding Cotton resistant to blackarm disease (Bact. malvacearum). Part II. Breeding methods.**—*Emp. J. exp. Agric.*, xiv, 56, pp. 161–174, 1 pl., 1946.

In this concluding article [*R.A.M.*, xxv, p. 499] the author describes how new cotton varieties resistant to *Bacterium* [*Xanthomonas*] *malvacearum* may be bred, tested, and graded for resistance. For the tests it is suggested that sterilized seed should be used and the plants sprayed with the bacterial inoculum to ensure standardized infection. The preparation of the inoculum and the spraying method are described. In breeding, for those varieties already carrying B_2 [loc. cit.] it is necessary to select those lines homozygous for this factor; for those not carrying B_2 it must be transferred from resistant varieties by a series (four to six) of back-crosses. Other breeding methods described are those by which B_1 and B_3 can be incorporated in strains already carrying B_2, or added, with B_2, to fully susceptible strains.

CURY (R.). **Moléstias das Abelhas.** [Bee diseases.]—*Biológico*, xii, 10, pp. 241–254, 7 figs., 1946.

Brief notes are given on the etiology, symptoms, diagnosis, and treatment of the bee diseases caused by *Aspergillus flavus*, *Mucor hiemalis*, and *Pericystis apis* [*R.A.M.*, xv, p. 217] in São Paulo, Brazil. Both *A. flavus* and *M. hiemalis* invade stomach, intestines, and body cavity of the insect, causing progressive restlessness and debility, and paralysis.

BHATT (R. S.). **Studies in the Ustilaginales. I. The mode of infection of the Bajra plant (Pennisetum typhoides Stapf) by the smut Tolyposporium penicillariae Bref.**—*J. Indian bot. Soc.*, xxv, 4, pp. 163–186, 1 pl., 19 figs., 1946.

A comprehensive, tabulated account is given of the author's experiments at Lucknow University on the mode of infection of *Pennisetum typhoides* by *Tolyposporium penicillariae* [*R.A.M.*, xx, p. 179].

Infection occurs only through the flower, which is most susceptible at an early stage of development before the stigma or anthers are externally perceptible. As growth proceeds infection becomes progressively less, and after pollination the flowers are virtually free from attack. In tests from 10th to 23rd September, 1942, the percentages of diseased ears from flowers inoculated when (*a*) enclosed within the glumes, (*b*) with peeping to semi-developed stigmas, (*c*) with mature stigmas, and (*d*) shrivelled stigmas and versatile anthers were 68·2, 52·7, 54·2, and 2·2,

respectively, the corresponding figures for the periods from 24th September to 10th October and from 15th to 31st October being 62·3, 57·1, 32, and 0 and 23·8, 11·1, 6·6, and 0, respectively. Dusting the stigmas with spore balls proved superior to the *in vacuo* method of inoculation [ibid., xv, p. 567 *et passim*] for the end in view. In a given variety the percentage and degree of infection were found to stand in direct relation to the humidity of the immediate environment, susceptibility to the smut being much greater in two localities visited under the humid conditions prevailing in the second week of September than during the dry weather in early November.

The invading mycelium of *T. penicillariae* pursues two courses. Most of the hyphae proceed from the stigma towards the receptacle, while others, after repeated branching, attack the ovary from the sides. Entry into the ovule and starchy endosperm is effected through the nucellus and micropyle and the tissues are gradually absorbed. In due course gelatinization of the hyphal walls proceeds from the receptacle and side walls of the ovary into the ovule and starchy endosperm in preparation for spore ball formation. The time elapsing between infection and spore formation was approximately a fortnight.

The seeds are entirely free from dormant mycelium and were experimentally shown to play no part in the initiation of infection, but the spores were found to hibernate in the soil without appreciable loss of viability; they germinate during the next rainy season in readiness for the next crop. The intensity of the disease increased annually with the successive cultivation of *P. typhoides*. Thus, in 1940, in a plot where the crop was grown after five to seven years' fallow, the smutted ears numbered 9 out of 762, while the corresponding figures for 1941 were 48 out of 344 and for 1942, 104 out of 442. It is suggested that if later-flowering varieties are cultivated they will flower in a drier period and escape infection.

Lissitzina (Mme M. I.). Клеверный рак. [Clover rot.]—St. Publ. Off. Lit. collect. co-op. Fmg 'Selkhozgiz', Moscow, 32 pp., 6 figs., 1944. [English summary. Received January, 1947.]

Serious damage to the clover crop is caused by *Sclerotinia trifoliorum* in regions of high humidity in the U.S.S.R. [*R.A.M.*, vi, p. 98; vii, p. 449; xix, p. 23]. The symptoms appear during the first autumn after sowing, and may persist through the second year with an interval of quiescence in the heat of summer. The fungus is able to complete its entire life-cycle from mycelium to apothecia as a saprophyte. The minimum, optimum, and maximum temperatures for mycelial growth are −2°, 21°, and 27° C., respectively, and the fungus is killed at 42° and −24°. The mycelium is active on and near the soil surface only until the onset of the hot weather. In the autumn following the dry summer of 1938, the sclerotia did not produce apothecia [cf. ibid., xx, p. 76; xxiii, p. 22].

In the writer's experiments, clover was infected by (*a*) mass inoculation with ascospores; (*b*) a small number of ascospores after germination on a standard nutrient medium, preferably carrot juice; (*c*) mycelium arising from ascospores developing saprophytically on the soil; (*d*) contact between diseased and healthy plants; and (*e*) mycelium radiating over the soil from infected plants. The spread of clover rot in the field is effected primarily by the mycelium. In the districts visited *S. trifoliorum* was found on a number of weeds, e.g., *Sonchus arvensis*, *Stellaria media*, *Myosotis intermedia*, *Galium mollugo*, and *Plantago media*, whence it may pass to clover. The following were experimentally infected by *Sclerotinia trifoliorum*: sunflower [ibid., ix, p. 655; xi, p. 652], parsley, carrot, lettuce, cucumber, vegetable marrow, and tomato, only the first-named, however, sustaining any injury. Conversely, *S. libertiana* [*S. sclerotiorum*] from vegetables induced in clover a disease similar to rot, while a species of *Botrytis* isolated from clover seeds caused a foliar decay in the same host.

S. trifoliorum is perpetuated on infested land by weeds and sclerotia produced in the soil, these being the chief sources of contamination in first-year clover. The elimination of weeds and the use of local clover strains are the most effective control measures.

Kreitlow (K. W.) & Myers (W. M.). **Resistance to crown rust in Festuca elatior and F. elatior var. arundinacea.**—*Phytopathology*, xxxvii, 1, pp. 59–63, 1 fig., 1947.

Most of the 14-chromosome meadow fescue (*Festuca elatior*) plants observed for their reactions to crown rust (*Puccinia coronata*) [*R.A.M.*, xvii, p. 23] at the United States Regional Pasture Research Laboratory, State College, Pennsylvania, in 1942 and 1943 were susceptible, while the 42-chromosome tall fescue (*F. elatior* var. *arundinacea*) was usually resistant. One collection of *F. elatior* from Maine, however, was immune from the disease. Additional material from the same and neighbouring fields proved to be either *F. elatior*, in which most of the plants were susceptible to crown rust, or *F. elatior* var. *arundinacea* varying in its reactions from susceptible to immune.

Leben (C.) & Keitt (G. W.). **The effect of an antibiotic substance on Apple leaf infection by Venturia inaequalis.**—Abs. in *Phytopathology*, xxxvii, 1, p. 14, 1947.

A species of *Streptomyces* was found to be antagonistic on agar to 29 phytopathogenic fungi but not to most of the bacteria tested, including those commonly used in antibiotic assays and certain plant pathogens [cf. *R.A.M.*, xxvi, p. 164]. For the preparation of concentrates of the antibiotic substance, the antagonist was grown in shake-flasks containing a maize-steep glucose medium. The active material was obtained by ethanol extraction of the precipitate formed when the culture was acidified with hydrochloric acid to pH 2·5. Further fractionation yielded a solution completely inhibiting the growth of *Venturia inaequalis* at 1 in 8,000,000 and of *Sclerotinia fructicola* at 1 in 11,000,000 (solids basis, agar-streak test method). Eleven months' storage at 8° C. did not appear to impair the activity of ethanol solutions, from which the active material is precipitated on the addition of water. In three greenhouse tests, the development of scab on susceptible apple leaves was prevented or greatly reduced by a single spray application of an ethanol solution of the active principle four hours or four days before inoculation with *V. inaequalis*.

Taylor (G. G.). **Spraying experiments for the control of ripe-spot (Neofabraea malicorticis) in the Sturmer Apple variety.**—*N.Z. J. Sci. Tech.*, A, xxvii, 6, pp. 457–469, 1946.

Effective control of ripe spot (*Neofabraea malicorticis*) in Sturmer apples can be secured in New Zealand [*R.A.M.*, xxiii, p. 233] by spraying with Bordeaux mixture. However, considerations of fruit and leaf injury and the inhibition of fruit colour development by heavy residues limit the dosage rates and periods at which the mixture can be safely applied. The following factors were experimentally shown to be important in the determination of treatments for the end in view. The critical period for spraying against *N. malicorticis* appears to extend from mid-January to mid-February, during which time the fruit is relatively resistant to russeting but subject to copper injury. An increase in the proportion of hydrated lime to copper sulphate reduces spray injury without impairing the toxicity of the mixture to the ripe-spot pathogen. Thus, in one trial the amount of copper injury was reduced from 20 per cent. in the blocks sprayed three times with Bordeaux 2–2–100 to 8·7 and 4·3 per cent., respectively, for the 2–4 and 2–8–100 formulae, while in another the percentages of the defect resulting from two applications of

the mixture at 2–2, 2–4, and 2–6–100 were 40·7, 29·8, and 24·2, respectively. A reduction in the ratio of copper sulphate to hydrated lime lessens spray injury, but permits an increase in ripe spot. For instance, with two applications at 1–6–100 the percentages of infected fruits and copper injury were 19·2 and 0, respectively, while at 2–6 and 4–6–100 they were 9·1 and 1·5 and 5·6 and 13·4, respectively. An admixture of 4 pts. sulphite lye as a wetter with Bordeaux mixture reduces copper injury, but tends to decrease the efficacy of the treatment. The addition of cottonseed oil at 4 or 6 pts. to the 2–2–100 formula significantly reduced the amount of copper injury (from 18·2 per cent. with 8 oz. lime-casein to 5·9 and 3, respectively), without affecting ripe-spot control, but the spray residues were commercially objectionable at all dosages. The combination of lime-casein with Bordeaux mixture overcomes most of the difficulties connected with spray residues and poor coloration. None of the substitutes tested, viz., perenox, cuprox, oxi-cop, bar-cop, and Burgundy mixture, proved superior to Bordeaux for ripe-spot control, and all caused more damage to the fruit and foliage.

It is concluded that under existing standards for russet-grading a spray programme meeting commercial requirements would consist of a mid-January application of Bordeaux 2–6–100 and a mid-February treatment of 1–4–100, with an admixture of 8 oz. lime-casein on each occasion.

Berkeley (G. H.). **Cherry yellows and necrotic ring spot of sour Cherry in Ontario. No. 1. The value of Prunus persica and P. domestica var. Italian Prune as index hosts.**—Abs. in *Phytopathology*, xxxvii, 1, pp. 2–3, 1947.

Necrotic ring-spot symptoms on sour cherry [*R.A.M.*, xxv, p. 266], comprising delayed foliation, chlorotic spots, rings, and leaf necrosis, are of the 'shock' type, admitting of eventual recovery, while the leaf-yellowing and leaf-shedding due to yellows is chronic, recurring year after year. Budding experiments indicated that every source of cherry yellows tested also contained the necrotic ring-spot virus, but the latter has been found to occur with no admixture of the former. Peach seedlings, of the Elberta or Rochester varieties, were further shown to be of value as indicator hosts. Peaches reacted to the necrotic ring-spot virus by 'shock' symptoms of retarded foliation, die-back, and bark necrosis, followed by recovery, except in cases of extreme severity. In the same host the cherry-yellows virus induced 'shock' symptoms resembling the foregoing and a chronic rosetting of the shoots that persist. Italian Prune infected either by the necrotic ring-spot virus alone or with the cherry-yellows complex developed foliar necrosis of the 'shock' type, while the latter virus also caused chronic symptoms comparable to those of prune dwarf [loc. cit.]. Cherry yellows and prune dwarf, however, are believed to be caused by distinct viruses, probably composed of several strains inducing varying reactions.

Darpoux (H.). **Étude sur l'anthracnose du Cerisier.** [A study on Cherry anthracnose.]—*Ann. Épiphyt.*, N.S., xi, 3–4, pp. 161–175, 10 figs., 1945. [Received February, 1947.]

Cherry anthracnose, due apparently to *Coccomyces hiemalis* [*R.A.M.*, xxiv, pp. 128, 265, 376; xxv, p. 402], was found for the first time in France in 1942, at Versailles, by Arnaud, who observed only the summer conidial state of the fungus; the disease had, apparently, been present the year before. In 1943, Viennot-Bourgin observed affected trees in nurseries near Paris and Lisieux (Calvados), and infected leaves were received by the author from Chevry-Cossigy (Seine-et-Marne). In September, 1945, the disease was reported from Angers and Toulouse. The damage has not, so far, been severe, appearing only as leaf spots at the end of August or early in September and causing the susceptible varieties to lose their leaves a month early.

During the author's studies, he found a microconidial form with bacillary spores and a winter conidial form. The acervuli of the summer conidia usually form protuberances on the lower surface of the spots, developing from a stroma between the epidermis and the mesophyll. The conidia emerge from the stroma on short conidiophores, eventually rupturing the epidermis and forming a whitish mass. The hyaline, elongated, bent or flexuose conidia are usually non-septate when young and show one or, rarely, two, septa at maturity; they measure 45 to 65 by 2·5 to 4μ. The production of these *Cylindrosporium* conidia ceases with the end of the growth period of the host.

Towards the end of September, 1945, the author found on leaves beginning to turn yellow that the spots were blackened and the whitish spore mass had disappeared. The conidial stroma now bore 1-celled, hyaline microconidia measuring 4 to 5 by 1·5 to 2μ on hyaline, usually branched conidiophores seldom over 30μ long. This appears to be the stage referred to *Phoma* by Arthur in 1886. Microconidia in fungi of this group are not uncommonly observed. The author recently found bacillary spores on chestnut leaves infected by *Cylindrosporium castanicola* [ibid., xx, p. 558] and quince leaves by *Entomosporium maculatum* [*Fabraea maculata*: ibid., xvii, p. 188].

In 1943–4 winter conidia of the cherry fungus were seen. By the end of April, the old stroma of the acervulus had changed to a globular pycnidium-like organ consisting of a mass of round, hyaline cells surrounded by a wall of dark cells. In the middle, long, hyaline conidia were forming on short conidiophores. By the middle of June, these organs were 250 to 300μ in diameter and almost completely filled with spores, which were expelled through a pore. The spores were hyaline, flexuose, mostly 1-septate, and measured 50 to 85 by 2μ; they tapered at the distal and were truncated at the proximal end. The leaves had been left for the winter in a bag placed against a wall looking south in a relatively dry situation. This conidial stage allowed the fungus to overwinter, and, in the absence of ascospores, brought about the first infections the following summer.

Arnaud reported that the varieties early Anglaise Royale and Guignier were those least affected, and Viennot-Bourgin cited Anglaise Royale and Montmorency. At Versailles in 1943, 1944, and 1945 Montmorency was the most susceptible, followed, in order of decreasing infection, by Bigarreau Jaboulay, Bigarreau Napoléon, and Guigne; one unknown variety was completely resistant. In another orchard, it was observed in September, 1945, that the lower branches and those facing north and north-west were the first to be attacked, sometimes becoming completely defoliated, while the others were scarcely affected. Bigarreau de Montauban and Bigarreau Pelissier were most affected, closely followed by Montmorency à courte queue, while Guigne, Early Rivers, and Guigne noire de Montreux were not attacked.

In 1942, Arnaud secured effective control with one application of 1 per cent. Bordeaux mixture, on 8th May, some time after flowering, while in 1943 the author obtained complete protection with two at the same concentration, on 9th May and 16th June. Further work is in progress.

Foster (W. R.) & Lott (T. B.). **'Little Cherry,' a virus disease.**—*Sci. Agric.*, xxviii, 1, pp. 1–6, 1 fig. 1947.

Little cherry disease [*R.A.M.*, xxii, p. 10] in British Columbia appeared first in 1933 in an orchard on the West Arm of Kootenay Lake, and has since spread with great rapidity to distances of 15 to 45 miles, with 100 per cent. infection in some districts.

Diseased trees appear to grow normally, symptoms developing only in the fruits. These become angular and tapering, and are reduced to half their normal size, the differences becoming apparent about two weeks before maturity. They remain

bright red, with deteriorated sweetness and flavour. Diseased trees bear numerous fruits which are conspicuous and not hidden by leaves. Such fruits can be used only for processing, not for the fresh-fruit trade.

That the disease is due to a virus was shown by budding experiments. In an isolated orchard, buds from affected trees set on 24 healthy Lambert and Republican trees gave a total infection of 16 definite cases in the following year and 22 in the second year, while the virus had spread naturally to 32 of the remaining 36 trees. Although the rapidity with which the virus spreads suggests several insect vectors, none has yet been found.

Of the two local wild cherries which might function as carriers, *Prunus emarginata* was shown by budding experiments to be virus-free and *P. demissa* awaits examination. No variety of sweet cherry is known to be immune or symptomless, Lambert and Republican being particularly susceptible. Sour cherries show similar symptoms, but peach trees are not infected naturally.

This disease can be distinguished from the sweet cherry buckskin disease [peach X-disease virus: ibid., xxv, p. 37], which it somewhat resembles, by the absence in little cherry of the buckskin appearance of the fruit skin near the stalk, no orange or maroon coloration of the leaves, and no general stunting.

McClintock (J. A.). **Spraying for Strawberry fruit rots in 1946.**—*Hoosier Hort.*, xxviii, 10, pp. 147–148, 1946.

The reduction in the Indiana strawberry crop of 1946 from the combined effects of protracted frosts at flowering time and fungal rotting (mostly *Botrytis* [*cinerea*]) of the berries during a continuous rainy spell in the harvesting season was estimated at a minimum of 60 per cent. Infection was particularly severe on soft-fruited varieties, such as Premier, Dunlop, Majestic, and Tennessee Beauty, while Dorsett, Blakemore, and Robinson were comparatively resistant. The results of spraying experiments with wettable sulphur on 15 varieties were not encouraging, the treatment not only failing to control the rot but also causing severe leaf scorch.

Chaves Batista (A.). **'Tipburn' do Abacateiro, em Pernambuco.** [Avocado tipburn in Pernambuco.]—*Bol. Agric., Pernambuco*, xiii, 3, pp. 136–139, 2 figs., 1946.

Tipburn of avocado having been observed in Pernambuco, Brazil, the available information on the symptoms, etiology, and control of the disease in the United States [*R.A.M.*, xx, p. 484] is summarized. Soil drainage, one of the most important control measures, has given excellent results at the Pernambuco State Fruit Growing Station.

Das Gupta (S. N.) & Bhatt (R. S.). **Studies in the diseases of Mangifera indica Linn. VII. Latent infection in the Mango fruit.**—*J. Indian bot. Soc.*, xxv, 4, pp. 187–203, 8 figs., 1946.

In further studies on mango diseases in the Lucknow district [*R.A.M.*, xxv, p. 127], 13 fungi were found to occur in varying frequencies in the atmosphere of an orchard containing mostly the Khajli and Phajli varieties, viz., *Aspergillus nidulans*, *A. niger*, *A.* sp., *Acrothecium penniseti* [ibid., i, p. 103], *A.* sp., *Alternaria* spp. 1 and 2, *Spondylocladium* sp., *Fusarium* spp. 1, 2, and 3, *Penicillium* sp., and *Rhizopus arrhizus*. Of these, *Aspergillus nidulans*, *A. niger*, and *F.* spp. 1 and 2 were present throughout the mango season, while the others made only occasional appearances. The incidence of *A. nidulans* reached a maximum between the end of April and the third week in June, *A. niger* and *F.* sp. 1 began with a high concentration which gradually fell and then rose, *Alternaria* sp. 1 and *Acrothecium*

penniseti were fairly common, and next in frequency came *Alternaria* sp. 2 and *Acrothecium* sp.

Five different fungi were isolated from the tissues of apparently healthy developing fruits (158 Khajli and 112 Phajli), namely, *Aspergillus nidulans* from 28 of the former and 16 of the latter variety, *A. niger* (9 and 9), *Acrothecium* sp. (4 and 5), *Alternaria* sp. 1 (5 and 3), and *F.* sp. 1 (37 and 30). Latent infections with *Aspergillus nidulans* were induced either by spraying the fruits with a concentrated conidial suspension or by the application of conidia to superficial wounds. The fruits were most susceptible when under 75 mm. long, their resistance increasing with advancing maturity. Conidia remained in large numbers on the fruit surface, to which some of them adhered firmly, as well as in the substomatal cavities. A more usual means of perpetuation of the fungus, however, is through hyphae of limited growth which remain dormant in the subcuticular region for about two months, their activity being resumed shortly before the picking of the fruits and reaching a climax during storage. The epidermis and outer mesocarp offer more resistance to the passage of *A. nidulans* than the underlying tissues, through which its lateral spread is more readily effected. Hence the extent of subsequent decay depends on the depth attained by the pathogen before the fruits are picked for ripening.

McCallan (S. E. A.). **The identity of Alternaria and Macrosporium cultures used for slide-germination tests of fungicides.**—*Contr. Boyce Thompson Inst.*, xiv, 5, pp. 323–324, 1946.

Cultures of a fungus frequently used in experiments by the author and others have been referred constantly to *Alternaria solani*, although some doubt has been cast upon the correctness of this reference [*R.A.M.*, xx, p. 543] because of the small size and abundance of the spores of the organism and its non-pathogenicity to tomatoes. A critical examination in the light of recent work on the genus [*Canad. J. Res.*, Sect. C., xxii, pp. 217–234, 1944; *R.A.M.*, xxv, p. 579] has shown that the species is really *A. oleracea* [ibid., ii, p. 301], a view which has been confirmed by J. A. Stevenson of the United States Department of Agriculture, and J. W. Groves of the Department of Agriculture, Ottawa, Canada. In reports of various slide-germination tests where this fungus has been used [ibid., xv, p. 733; xvii, p. 540; xx, p. 543; xxii, pp. 145, 146; xxiii, p. 35; xxv, p. 401] it is named incorrectly *A. solani* instead of *A. oleracea*. The author points out that in greenhouse tests on tomatoes [ibid., xxiii, pp. 34, 139] and a sporulation study [ibid., xxiv, p. 115] *A. solani* proper was used.

Stemphylium sarcinaeforme [*sarciniforme*] is formally adopted in place of the synonym *Macrosporium sarcinaeforme* previously used by the author.

Delasnerie (J.). **Pulvérisation et pulvérisateurs.** [Spraying and sprayers.]—*Rev. Vitic., Paris*, xcii, 12, pp. 362–365, 5 figs., 1946.

This is a technical discussion of the means by which spraying machines could be made to deliver a very fine and homogeneous spray, and by which their operation can be facilitated. The author concludes from practical researches that jets must be well made and of hard, non-corroding metal. With jets of the Gobet type a greater volume of fine spray is secured and large drops eliminated if the orifice is a cylinder the length of which is definitely greater than the diameter.

Moore (M. B.) & Kommedahl (T.). **A technique for making serial dilutions.**—Abs. in *Phytopathology*, xxxvii, 1, p. 16, 1947.

A hypodermic syringe fitted with a 6-in. delivery tube is used for the accurate and aseptic dispensing of a known volume of a medium, say, 10 c.c., to each culture

tube in a dilution series, to the first of which 10 c.c. of a stock solution, e.g., of a fungicide, is then added. Thorough mixing is effected by repeated manipulation of the plunger of the syringe, while the delivery tube is inserted in the culture tube. A 10 c.c. portion of the first dilution is then drawn up, delivered into the second tube, and mixed, and so on throughout the series, in which each tube is one-half the concentration of the preceding one. Other ratios, such as 1:3:9, 1:4:16, and 1:10:100, may be used. In 890 tubes of serial dilutions only five contaminations occurred.

ARNSTEIN (H. R. V.), COOK (A. H.), & LACEY (M[ARGARET] S.). **Production of antibiotics by fungi. Part II: Production by Fusarium javanicum and other Fusaria.**—*Brit. J. exp. Path.*, xxvii, 6, pp. 349–355, 1946.

Of 19 species and strains of *Fusarium* investigated, 12 developed anti-bacterial culture solutions under selected conditions, viz., one strain of *F. culmorum* (against *Mycobacterium phlei*), *F. fructigenum* (*M. phlei*), two strains of *F.* (?) *lateritium* and one of *F. avenaceum* (*Staphylococcus aureus* and *M. phlei*), *F. sambucinum* (*M. phlei*, with a weaker action on other bacteria), and several unidentified strains, including one (F 6) similar to *F. fructigenum* (*M. phlei*) and another (F 64) antagonistic to *S. aureus* and *M. phlei*.

The production of two anti-bacterial pigments, javanicin and oxyjavanicin (naphthoquinones), by selected strains of *F. javanicum* [*R.A.M.*, xxv, p. 271] under a variety of conditions was examined. In addition to its inhibitory effects on a number of bacteria, including *M. phlei*, *S. aureus*, *B*[*acillus*] *subtilis*, and the plant pathogen, *Bact*[*erium: Corynebacterium*] *fascians*, javanicin displayed a feeble but specialized antagonism towards *Penicillium notatum*, *F. sambucinum*, *F. lateritium*, and *F. javanicum* in malt-bacto-tryptone or eupepton agar plate cultures.

NEUBERG (C.). **The biochemistry of yeast.**—*Annu. Rev. Biochem.*, xv, pp. 435–474, 1946.

The industrial applications of *Torulopsis utilis* [*R.A.M.*, xxvi, p. 116] and other yeasts are among the references to work of mycological interest in this survey of recent studies on yeast metabolism, which is supplemented by a bibliography of 278 titles.

ESBO (H.). **En del vanliga Potatissorters reaktion mot vissa vira.** [The reaction of a number of common Potato varieties to certain viruses.]—*K. LandtbrAkad. Handl., Stockh.*, lxxxiv, 4, pp. 299–313, 1945. [German summary.]

Investigations were carried out in Sweden from 1941 to 1944 to determine (*a*) the effects of virus Y, alone and in conjunction with virus X, on 12 widely grown potato varieties, and (*b*) the relation between the foliar symptoms and tuber yields [cf. *R.A.M.*, xxv, p. 77; xxvi, p. 25]. In the first experiment cylinders of tissue were bored out of sound tubers and replaced by similar material from diseased plants, the combined virus inoculum being furnished by Up-to-Date and that of virus Y by Sharpe's Express. The infected tubers were planted out in the spring. In the second test healthy tubers were grown surrounded by diseased ones, and the harvested tubers were replanted in the following year for observation.

The symptoms developing on the individual varieties were reasonably constant. The Swedish Gloria showed very marked crinkle and shortening of the petioles and leaves, but no necrosis or defoliation, while the other graft-inoculated varieties displayed virus Y symptoms of variable intensity which developed early and were most pronounced in Dunbar Yeoman and Up-to-Date. Early Puritan showed abnormal crinkle, mosaic spotting of the leaves at a very early stage, petiole and

leaf necrosis, compression and generalized stunting, brittleness, defoliation, and early withering. Eight other varieties [details of which are given] vary in the development of necrosis, compression, brittleness, stunting, and defoliation. Somewhat different results were obtained in the trial involving uniform exposure to spontaneous infection. For instance, the progeny of Early Puritan developed no necrosis and only slight mosaic, so that infection by virus Y had evidently not been transmitted, possibly because the diseased plants perished too soon for the aphid vectors (primarily *Myzodes* [*Myzus*] *persicae*) to acquire the infective material for dissemination. A similar lack of infection characterized the offspring of Irish Cobbler. Details are also given of the symptoms in the other varieties tested.

In general, the average reduction in tuber weight was correlated with the severity of the foliar symptoms. The yields from the progeny of inoculated Early Puritan, Irish Cobbler, and King Edward VII showed no uniform reduction as compared with those of the year of infection, but there were heavy falls in tuber weight in the case of Up-to-Date, Dunbar Yeoman, Bintje, and Erdgold.

Folsom (D.). **Potato yellowtop and unmottled curly-dwarf in Maine.**—*Bull. Me agric. Exp. Sta.* 446, pp. 87–95, 15 pl., 1946.

After a brief review and comparison of the virus diseases of Maine potatoes the author describes the symptoms of yellow top [potato apical leaf roll virus: *R.A.M.*, viii, p. 395; xxi, p. 499] as characterized by dwarfing and premature death of the plants, spindling, net necrosis, aerial tubers, an occasional necklace arrangement of the tubers on the stolons, and by stiff leaf texture associated sometimes with extreme necrosis and sometimes with leaf rolling and yellowing.

Potato unmottled curly dwarf [? a strain of potato spindle tuber: ibid., x, p. 50], a disease serious in Nebraska but detected in Maine only once outside the experimental plots, is distinguished from mottled curly dwarf (caused by potato leaf-rolling mosaic plus spindle tuber viruses) by the absence of mottling, and from spindle tuber by the greater leaf distortion, dwarfing, leaf burning, stem streaking, tuber gnarling and cracking, and occasional pith necrosis of the tubers. This last symptom is identical with that caused by yellow-dwarf virus [ibid., xv, p. 42]. Concerning the precise identity of the causal agents of these virus diseases and their relation with other somewhat loosely defined potato viruses, the evidence is confused. The author concludes that the Maine yellow top disease may be identical with one or more of a group including the aster yellows, purple top [a strain of aster yellows virus], witches' broom, and apical leaf roll viruses. Certainly in a year when an epidemic of aster yellows occurred owing to abundance of aster leaf hoppers [*Macrosteles divisus*] there was an increase in both yellow top and purple top in potatoes. Potato unmottled curly dwarf was thought to be transmitted from weeds by agalliar leafhoppers [*Agalliopsis* spp.], which transmit diseases of the yellow dwarf type [ibid., xxiii, p. 490].

Branas (J.). **Essais de produits anti-mildiou à l'École nationale d'Agriculture de Montpellier.** [Experiments with anti-mildew products at the National School of Agriculture of Montpellier.]—*Progr. agric. vitic.*, cxxii, 5–6, p. 27; 7–8, p. 43, 1945. [Abs. in *Ann. Épiphyt.*, N.S., xii, 1, p. 67, 1946.]

Field trials carried out in 1944, a year of slight infection, with various materials against vine mildew [*Plasmopara viticola*: *R.A.M.*, xxv, pp. 382, 537] again demonstrated that for an equal copper content copper oxychloride was less active than Bordeaux mixture, as also was copper-Sandoz. Bayer 23–17 W was equivalent in effect to Bordeaux mixture 0·1 per cent., its action being solely due to its copper content, i.e., 2·5 per cent. copper oxychloride. The author concludes that, Burgundy mixture apart, a given quantity of copper applied in the form of Bordeaux mixture is more active against *P. viticola* than if used in any other form.